

Temperature Sensors

SOR® manufactures a complete line of thermocouple elements, Resistance Temperature Detector (RTD) sensors, thermowells, industrial assemblies and specialty temperature sensors at our Lenexa, Kansas and Houston, Texas facilities. Products include multipoint temperature sensors, sanitary RTDs, high temperature furnace thermocouples, surface/tubeskin thermocouples and so much more to suit a wide variety of industrial applications and OEM markets.

With broad industry experience, technical expertise, and state-of-the-art facilities, we can meet both demanding and general purpose temperature measurement requirements.



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Design and specifications are subject to change without notice.

All RTDs are 100% tested to insure that the accuracy and the continuity of the product have not been affected by the manufacturing process. The standard sheath material on all RTDs specified in this section is 316SS. Other sheath materials and coatings are available. Specify using model 1150 on page 4. Elements are either thin film or wire wound, depending on the style RTD selected. Thin film elements are used in all constructions unless otherwise specified. Each RTD is supplied with a heavy duty spring.

STANDARD RTD SPECIFICATIONS

Element Material: Platinum

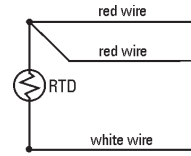
Element Type: 100 ohms @ 0°C,
0.00385 DIN Curve

RTD Type: Three wire
(Color code: red, red, white)

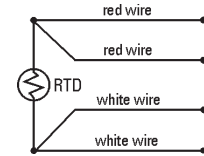
Wire Gauge: 22 Gauge

WIRE CONFIGURATIONS

Three Wire (Standard)



Four Wire



ACCURACY TOLERANCES

for platinum resistance elements are defined by DIN EN 60751 (ITS 90) as follows:

Class B: $\Delta t = \pm (0.3 + 0.005 |t|)$

Class A: $\Delta t = \pm (0.15 + 0.002 |t|)$

1700: $\Delta t = \pm 0.1(0.3 + 0.005 |t|)$

Class	Temperature Range	
	°C	°F
Class B	-70° to +500°	-94° to +932°
Class A	-50° to +300°	-58° to +572°
1700	0° to +150°	+32° to +302°

DESIGN TYPES

The design types provide environmental and accuracy solutions to virtually any process RTD application. Accuracy options offer the user more choices for tighter process control. Class B accuracy has long been the work horse of the industrial RTD temperature loop and is a good fit for most process needs. Slightly better than Class B is Class A accuracy which has long filled the void for the most demanding accuracy needs. The 1700 Smart Sensors have surpassed the Class A specifications for those applications where process accuracy must be measured in hundredth's of a degree. Optional NIST certification for 1700 products can be supplied and the accuracy statement is the finished product profile not just the accuracy of the element. The stability and accuracy of this product may eliminate costly and cumbersome sensor matching.

DESIGN TYPE CODES

- PO** This design uses nickel clad copper lead wire insulated with Teflon®. Maximum upper temperature rating of 500°F (260°C).
- PH** Our high temperature version can be used up to 900°F (482°C), and uses fiberglass leads.
- PM** Heavy duty applications is where this style should be specified. It is suited for temperatures up to 900°F (482°C). Mineral insulated cable is used for this type of RTD. Can be used in cryogenic applications at temperatures down to minus 200°F (-129°C).
- RN** 120 Ohm nickel @ 0°C (Edison #7) Color code: red, red, black. (DIN 43760)
- 1700** Higher accuracy (available in 1/4" Single 4 wire & Dual 4 wire only). Maximum temperature rating of 302°F (150°C).

To order indicate a code/value for each component. Leave blank for standard.

TYPE	OD	ELEMENTS	LENGTH ¹	MATERIAL	OPTIONS
PO	18 = 1/8" (3.2 mm)	S = Single	(Inches)	R = 316SS	TW = 2 Wire
PH	316 = 3/16" (4.8 mm)	D = Dual			FW = 4 Wire
PM	14 = 1/4" (6.4 mm)				GA = Class A
RN	38 = 3/8" (9.5 mm)				HV = High Vibration (PM)
1700	14 = 1/4" only (6.4mm)				CR = Cryogenic (PM)

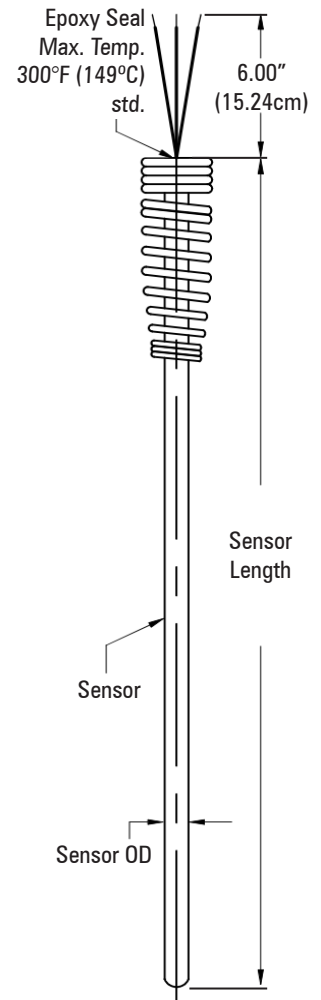
Notes

¹ Length is determined by assembly when used in well or protection tube.

To determine the length for replacement RTD's use the following formula:

$$U \text{ Length of well} + T \text{ Length} + A \text{ Length} + 0.50" = \text{Sensor Length}$$

See pages 12-16 for description of U, T & A lengths depending on type of well.



To order indicate a code/value for each component.

SENSOR TYPE						TERMINATION	OPTIONS
1150					R		
Sensor Type	RTD Type	OD	Construction	Sheath Length (inches)	Sheath Material		

SENSOR TYPE

RTD TYPE

RP 100 ohm Platinum Temperature Coefficient .00385 ohms/ohm/°C

RN 120 ohm Nickel (Edison #7) Temperature Coefficient 0.00672 ohms/ohm/°C

Other temperature coefficients and ohm values available.

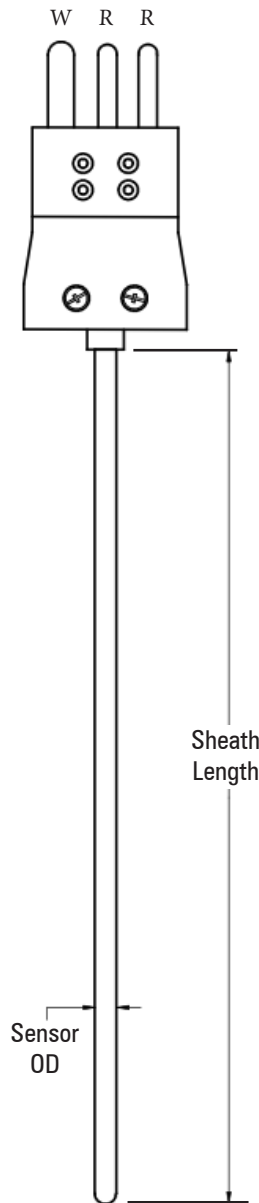
Note: Three-wire is standard.
Class B is standard.
Tolerance per DIN Standard 60751

OD

18 1/8" (3.2 mm)
316 3/16" (4.8 mm)
14 1/4" (6.4 mm)
38 3/8" (9.5 mm)

CONSTRUCTION

L Low Temp up to 500°F (260°C)
H High Temp up to 900°F (482°C)
M Mineral Insulated to 900°F (482°C)
DL Dual Low Temp up to 500°F (260°C)
DH Dual High Temp up to 900°F (482°C)
DM Dual Mineral Insulated to 900°F (482°C)



TERMINATION

1	Bare Ends - 1" (2.54 cm) std. For longer leads, see Type 1250	
11	Spade Lugs	
12	Large Three Pin Plug	
13	Large Three Pin Jack	
14	Mini Three Pin Plug	
15	Mini Three Pin Jack	

OPTIONS

BA	Bayonet Adapter (Adjustable) 1/8" (3.2 mm) OD only	FW	Four-Wire (without connector)
BF	Bayonet Cap & Spring, 1/8" (3.2 mm) and 3/16" (4.8 mm) OD only	GA	Class A
	Note: inches from cap to tip (fixed)	HV	High Vibration (M Construction)
BD45	45° Bend in Sheath Note: inches from bend to tip	LB	Connector "L" Bracket
BD90	90° Bend in Sheath Note: inches from bend to tip	SS18	Adj SS Comp Fitting 1/8" NPT*
BR18	Adj Brass Comp Fitting 1/8" NPT*	SS14	Adj SS Comp Fitting 1/4" NPT*
BR14	Adj Brass Comp Fitting 1/4" NPT*	SS12	Adj SS Comp Fitting 1/2" NPT*
BR12	Adj Brass Comp Fitting 1/2" NPT*	TF	Teflon® Coated Sheath
CR	Cryogenic (M Construction)	VH	Vent Hole in Compression Fitting
CV	Connector with Epoxy Sealed Screws		*Add T after SS or BR for Teflon® Ferrule

See page 24 for complete option descriptions.

To order indicate a code/value for each component.

SENSOR TYPE								TERMINATION	OPTIONS
1250					R				
Sensor Type	RTD Type	OD	Construction	Sheath Length (inches)	Sheath Material R - 316SS Other sheaths available	Lead Length (inches)	Lead Insulation		

SENSOR TYPE

RTD TYPE

RP 100 ohm Platinum Temperature Coefficient 0.00385 ohms/ohm/°C

RN 120 ohm Nickel (Edison #7) Temperature Coefficient 0.00672ohms/ohm/°C

Other temperature coefficients and ohm values available.

Note: Three-wire, Class B RTD is standard. Tolerance per DIN Standard 60751. Leadwire is nickel clad copper multistrand.

Color code: Platinum - Red/Red/White
Nickel - Red/Red/Black

OD

18 1/8" (3.2 mm)
316 3/16" (4.8 mm)
14 1/4" (6.4 mm)
38 3/8" (9.5 mm)

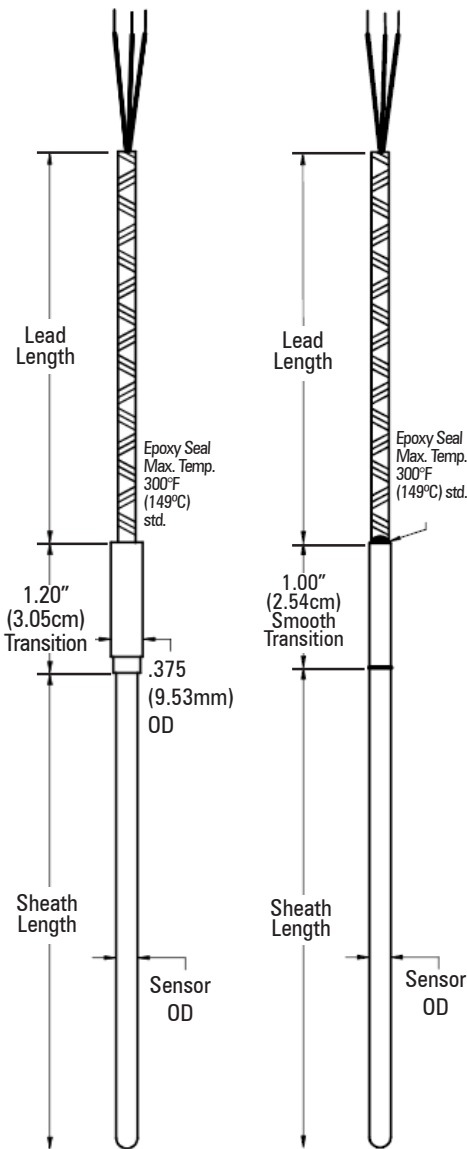
CONSTRUCTION

L Low Temp up to 500°F (260°C)
H High Temp up to 900°F (482°C)
M Mineral Insulated to 900°F (482°C)
DL Dual Low Temp up to 500°F (260°C)
DH Dual High Temp up to 900°F (482°C)
DM Dual Mineral Insulated to 900°F (482°C)

SHEATH MATERIAL

R 316SS

See page 24 for additional materials.



LEAD INSULATION

M F Multi Strand (flexible) Fiberglass 22 gauge (use with high temperature)

M T Multi Strand (flexible) Teflon® 22 gauge (use with low temperature)

Note: 1/8" (3.2 mm) OD - 24 gauge

TERMINATION

1	Bare Ends	
		2 1/2" (6.35 cm) std.
11	Spade Lugs	
12	Large Three Pin Plug	
13	Large Three Pin Jack	
14	Mini Three Pin Plug	
15	Mini Three Pin Jack	

OPTIONS

A Armor (Stainless Steel)
AP Armor with PVC Jacket
AT Armor with Teflon® Jacket
BA Bayonet Adapter (Adjustable) 1/8" (3.2 mm) OD only
BF Bayonet Cap & Spring, 1/8" (3.2 mm) and 3/16" (4.8 mm) OD only
Note: inches from cap to tip (fixed)
BD45 45° Bend in Sheath Note: inches from bend to tip
BD90 90° Bend in Sheath Note: inches from bend to tip
BR18 Adj Brass Comp Fitting 1/8" NPT*
BR14 Adj Brass Comp Fitting 1/4" NPT*

BR12 Adj Brass Comp Fitting 1/2" NPT*
BS Bell Spring Transition Relief
CG12 Weather Tight Fitting 1/2" NPT
CR Cryogenic (M Construction)
CV Connector with Epoxy Sealed Screws
DE12 Double Ended Hex Fitting, 1/2" NPT Spring Loaded
FW Four-Wire (without connector)
GA Class A
HTP High Temperature Potting Service over 400°F (204°C)
HV High Vibration (M Construction)
LB Connector "L" Bracket
NT No Transition, (Sheath length is over all length)

SB Stainless Steel Overbraided Leads
SS18 Adj SS Comp Fitting 1/8" NPT*
SS14 Adj SS Comp Fitting 1/4" NPT*
SS12 Adj SS Comp Fitting 1/2" NPT*
ST Smooth Transition, 3/16" (4.8 mm) OD and larger
TA Tube on Armor, 1/4" (6.35 mm) OD x 2" (50.8 mm) long
TF Teflon® Coated Sheath
VH Vent Hole in Compression Fitting
WC Wire Clamp Bracket for Leads
WP Weld Pad, 1" (2.54 cm) x 1" (2.54 cm) x 1/8" (0.32 cm) SS

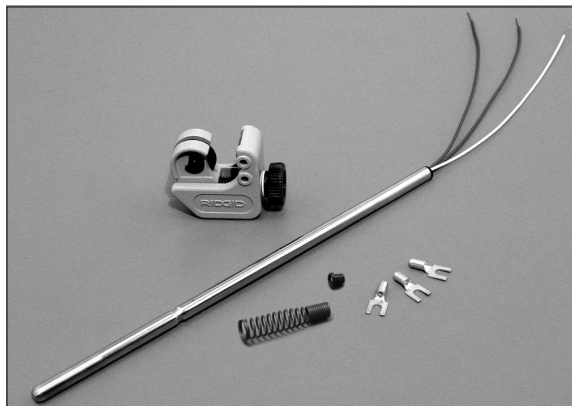
*Add T after SS or BR for Teflon® Ferrule

See page 24 for complete option descriptions.

Field Adjustable Thermocouples and RTDs

Today's high inventory costs plus the need for quick turnaround on plant maintenance projects or the routine replacement of thermocouples and RTDs dictates the need for standardization.

Now you can standardize on one length sensor for all your temperature requirements. Our Type ATC, APO, and APH sensors are easily cut to length in the field to a minimum of 3 inches (7.62 cm) long. The removable grommet is easily reinserted into the sheath and protects the leads from abrasion and provides some mechanical relief. All adjustable sensors are also supplied with a heavy duty spring.



Field adjustable thermocouples and RTDs may be ordered as a "PAK" option. PAKs include a tube cutter, extra grommet, spring, and spade lugs.

Thermocouple Specifications					RTD Specifications			
Wire Type: Fiberglass insulated 20 gauge solid					Accuracy: Per DIN EN 60751, Class B			
Sheath: 0.250" (6.4 mm) OD 316 stainless steel					Bulb Type: 100 ohm Platinum 0.00385 DIN Curve			
Maximum Temperature: 900°F (482°C)					Wire Type: Teflon® insulated 22 ga. multi-stranded APO; Fiberglass insulated 22 ga. multi-stranded APH			
To order select a designator code for each component.					Sheath: 0.250" (6.4 mm) OD 316 stainless steel			
Thermocouple					Maximum Temperature:			
ATC								
Type	Calibration	Std. Lengths	Junction	Options	APO - up to 500°F (260°C); APH - up to 900°F (482°C)			
J	Iron Constantan®	18" (45.7 cm)	G Grounded	PAK	To order select a designator code for each component.			
K	Chromel® Alumel®	24" (60.96 cm)	U Ungrounded	DEI2	RTD			
T	Copper Constantan®	30" (76.2 cm)	DG Dual Grounded		Type	Std. Lengths	Elements	Options
E	Chromel® Constantan®	36" (91.44 cm)	DU Dual Ungrounded		APO	18" (45.7 cm)	S Single	PAK
					APH	24" (60.96 cm)	D Dual	DEI2
						30" (76.2 cm)		(Double-ended Spring
						36" (91.44 cm)		Loaded 1/2" NPT)

NOTE: "PAK" option consists of a tube cutter, extra grommet and spade lugs.

Unprotected Thermocouples

At times due to economic reasons, a non-mineral insulated cable thermocouple type is required. Unlike sheathed types these thermocouples are unprotected from oxidation or chemical attack. Consequently their life expectancy is considerably shorter than that of an MI cable design.

To order indicate a code/value for each component. Refer to table 1 for "type" and "calibration" options.

To order select a designator code for each component.

Thermocouple		
Type	Calibration	Length
Select from Table 1 at right. (Inches)		

Example:

Unprotected thermocouple order code: 30-K-14 = Single beaded Chromel® Alumel®, 8 gauge, 0.500" (12.7 mm) OD, 14" (35.56 cm) long.

Table 1

Type	Diameters		Wire Gauge	Calibration
	Single	Dual		
10	0.150" (3.8 mm)		20	J, K, T, E
15		0.187" (4.8 mm)	20	J, K, T, E
20	0.250" (6.4 mm)		14	J, K, T, E
25		0.313" (7.9 mm)	14	J, K, T, E
30	0.500" (12.7 mm)		8	J, K, T, E
35		0.550" (13.9 mm)	8	J, K, T, E
40	0.153" (3.9 mm)		24	R & S
45		0.187" (5.0 mm)	24	R & S

M.I. Cable Thermocouple Elements

All industrial thermocouples are manufactured using a high purity mineral oxide insulation and a metallic sheath. The standard sheath material unless otherwise noted is 316SS. The ODs found in this section are those that are typically used when an element is housed in a well or protection tube. Each industrial thermocouple is supplied with a heavy duty spring.

Wire Gauge: 20 gauge solid Teflon® insulated

To Order

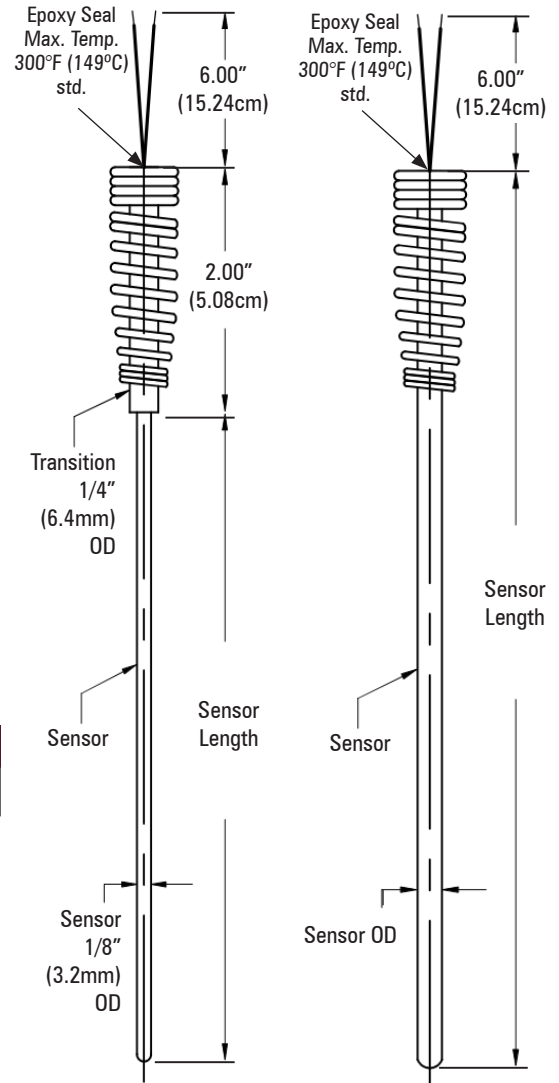
- For elements used in wells or protection tubes, indicate the code letter or value for each component.

Example: A replacement thermocouple with these specifications: Iron/Constantan®, 0.250" (6.4 mm) OD, grounded measuring junction, with a 316SS sheath, and 12" (30.48 cm) length would have the order code: J-14-G-R-12

CALIBRATION ¹	OD ²	JUNCTION	SHEATH ³	LENGTH ⁴
J = Iron Constantan®	18 = 1/8" (3.2 mm)	G = Grounded	P = 304SS	(Inches)
K = Chromel® Alumel®	316 = 3/16" (4.8 mm)	U = Ungrounded	R = 316SS	
T = Copper Constantan®	14 = 1/4" (6.4 mm)	E = Exposed	Q = 310SS	
E = Chromel® Constantan®	516 = 5/16" (7.9 mm)	DG = Dual Grounded	A = Alloy 600	
N = Nicrosil® Nisil®	38 = 3/8" (9.5 mm)	DU = Dual Ungrounded		
		DE = Dual Exposed		

Notes

- For Special Limits repeat calibration code i.e. JJ.
- 1/8" (3.2 mm) OD thermocouple comes with a 1/4" (6.4 mm) OD 2" (5.08 cm) long stainless steel transition. (See drawing above.)
- Other Sheath Materials available - consult factory.
- Length determined by assembly when used in a well. For replacement thermocouples use the following formula:
 $U \text{ Length of well} + T \text{ Length} + A \text{ Length} + 0.50" = \text{Sensor Length}$ (See pages 12-17 for description of U, T & A lengths.)



Temperature Sensors

Type 1100 with Plug - Thermocouples

To order indicate a code/value for each component.

SENSOR TYPE						TERMINATION	OPTIONS
1100							
Sensor Type	Calibration	OD	Junction	Sheath Length (inches)	Sheath Material		

SENSOR TYPE

CALIBRATION

J	Iron Constantan®
K	Chromel® Alumel®
T	Copper Constantan®
E	Chromel® Constantan®
N	Nicrosil® Nisil®
R	Platinum 13% Rhodium
	Pure Platinum
S	Platinum 10% Rhodium
	Pure Platinum

OD

125	1/25" (1.0 mm)
116	1/16" (1.6 mm)
18	1/8" (3.2 mm)
316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
516	5/16" (7.9 mm)
38	3/8" (9.5 mm)

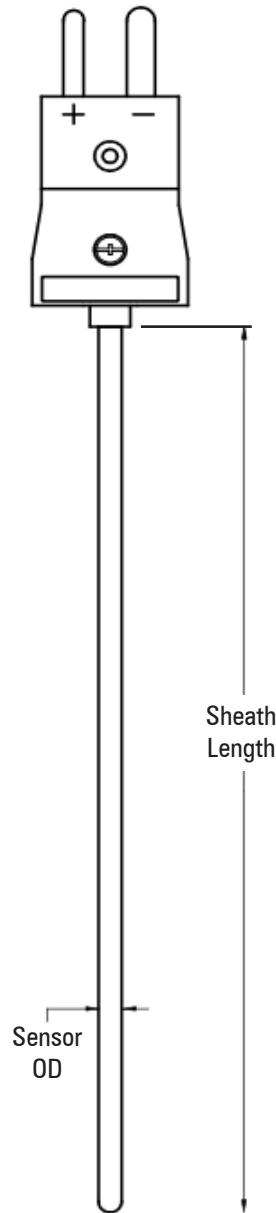
JUNCTION

G	Grounded
U	Ungrounded
E	Exposed
DG	Dual Grounded
DU	Dual Ungrounded
DE	Dual Exposed

SHEATH MATERIAL

P	304SS
R	316SS
Q	310SS
A	Alloy 600

Standard Sheath Material is 316SS.
Other sheaths available.



TERMINATION

1	Bare Ends - 1" (2.54 cm) std. <i>For longer leads, see Type 1200</i>	
2	Large Plug	
3	Miniature Plug	
4	Hi Temp Large Plug	
5	Large Jack	
6	Miniature Jack	
7	Hi Temp Large Jack	
8	Dual Large Plug*	
9	Dual Large Jack*	
10	Terminal Head	
11	Compensated Spade Lugs	
12	Three Pin Plug	
13	Three Pin Jack	

* Two single connectors are bracketed for MI cable termination.

OPTIONS

BA	Bayonet Adapter (Adjustable) 1/8" (3.2 mm) OD only	CV	Connector with Epoxy Sealed Screws
BF	Bayonet Cap & Spring, 1/8" (3.2 mm) and 3/16" (4.8 mm) OD only Note: inches from cap to tip (fixed)	LB	Connector "L" Bracket
BD45	45° Bend in Sheath Note: inches from bend to tip	SS18	Adj SS Comp Fitting 1/8" NPT*
BD90	90° Bend in Sheath Note: inches from bend to tip	SS14	Adj SS Comp Fitting 1/4" NPT*
BR18	Adj Brass Comp Fitting 1/8" NPT*	SS12	Adj SS Comp Fitting 1/2" NPT*
BR14	Adj Brass Comp Fitting 1/4" NPT*	TF	Teflon® Coated Sheath
BR12	Adj Brass Comp Fitting 1/2" NPT*	VH	Vent Hole in Compression Fitting

*Add T after SS or BR for Teflon® Ferrule

See page 24 for complete option descriptions.

Temperature Sensors

Type 1200 with Leads - Thermocouples

To order indicate a code/value for each component.

SENSOR TYPE								TERMINATION	OPTIONS
1200									
Sensor Type	Calibration	OD	Junction	Sheath Length (inches)	Sheath Material	Lead Length (inches)	Lead Insulation		

SENSOR TYPE

CALIBRATION

J	Iron Constantan®
K	Chromel® Alumel®
T	Copper Constantan®
E	Chromel® Constantan®
N	Nicrosil® Nisil®
R	Platinum 13% Rhodium Pure Platinum
S	Platinum 10% Rhodium Pure Platinum

OD

125	1/25" (1.0 mm)
116	1/16" (1.6 mm)
18	1/8" (3.2 mm)
316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
516	5/16" (7.9 mm)
38	3/8" (9.5 mm)

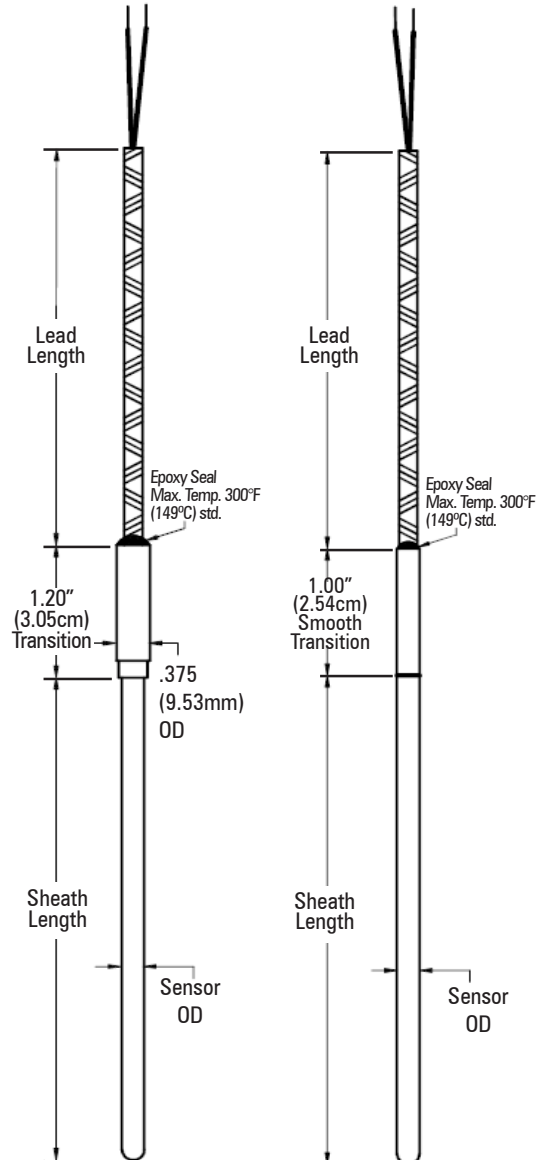
JUNCTION

G	Grounded
U	Ungrounded
E	Exposed
DG	Dual Grounded
DU	Dual Ungrounded
DE	Dual Exposed

SHEATH MATERIAL

P	304SS
R	316SS
Q	310SS
A	Alloy 600

Standard Sheath Material is 316SS.
Other sheaths available.



LEAD INSULATION

F	Fiberglass 20 gauge solid
K	Kapton® 20 gauge solid
T	Teflon® 20 gauge solid
P	PVC 20 gauge solid
P S	PVC w/Shield and Drainwire 20 gauge solid
M F	Multi Strand (flexible) Fiberglass 20 gauge
M T	Multi Strand (flexible) Teflon® 20 gauge

TERMINATION

1	Bare Ends	2 1/2" (6.35 cm) std.
2	Large Plug	
3	Miniature Plug	
4	Hi Temp Large Plug	
5	Large Jack	
6	Miniature Jack	
7	Hi Temp Large Jack	
8	Dual Large Plug*	
9	Dual Large Jack*	
11	Compensated Spade Lugs	
12	Three Pin Plug	
13	Three Pin Jack	

* Two single connectors are bracketed for MI cable termination.

OPTIONS

A	Armor (Stainless Steel)
AP	Armor with PVC Jacket
AT	Armor with Teflon® Jacket
BA	Bayonet Adapter (Adjustable) 1/8" (3.2 mm) OD only
BF	Bayonet Cap & Spring, 1/8" (3.2 mm) and 3/16" (4.8 mm) OD only Note: inches from cap to tip (fixed)
BD45	45° Bend in Sheath Note: inches from bend to tip
BD90	90° Bend in Sheath Note: inches from bend to tip

BR18	Adj Brass Comp Fitting 1/8" NPT*
BR14	Adj Brass Comp Fitting 1/4" NPT*
BR12	Adj Brass Comp Fitting 1/2" NPT*
BS	Bell Spring Transition Relief
CG12	Weather Tight Fitting 1/2" NPT
CV	Connector with Epoxy Sealed Screws
DE12	Double Ended Hex Fitting, 1/2" NPT Spring Loaded
HTP	High Temperature Potting Service over 400°F (204° C)
LB	Connector "L" Bracket (Standard Plug Only)
NT	No Transition
SB	Stainless Steel Overbraid Leads
SS18	Adj SS Comp Fitting 1/8" NPT*

SS14	Adj SS Comp Fitting 1/4" NPT*
SS12	Adj SS Comp Fitting 1/2" NPT*
ST	Smooth Transition, 3/16" (4.8 mm) OD and larger
TA	Tube on Armor, 1/4" (6.4 mm) OD x 2" (50.8 mm) long
TF	Teflon® Coated Sheath
VH	Vent Hole in Compression Fitting
WC	Wire Clamp Bracket for Leads
WP	Weld Pad, 1" (2.54 cm) x 1" (2.54 cm) x 1/8" (0.32 cm) SS

*Add T after SS or BR for Teflon® Ferrule

See page 24 for complete option descriptions.

Remote Mounted Sensors - Type 1340

The 1340 is easily installed, reduces vibration damage to the head and eliminates stocking several different lengths. This versatile design can be inserted into an existing well or used in other general purpose applications where a well or protection tube is not required. The exact immersion depth is not required when inserting in a well. Simply bottom the sensor to the bottom of the well and tighten the optional compression fitting. The 1340 allows a reduction in store room lengths due to this flexibility.

The flexible armor leads allows remote mounting of the head in applications where there is a very tight fit. In high temperature thermocouple applications it is recommended that sensor connections are in a area that has ambient temperatures below 400°F (204.4°C). The 1340 design allows the head to be mounted remotely, an option that can greatly enhance the accuracy of the measurement.

To order indicate a code/value for each component.

HEAD		SENSOR TYPE							OPTIONS		THERMOWELL (Optional) *			
Type	1340	Type	Calibration	OD	Junction	Sheath Length (inches)	Sheath Material	Lead Length (inches)	Lead Wire	Well Type	U Length	Material	T Length	

*see pages 13-14 for selection

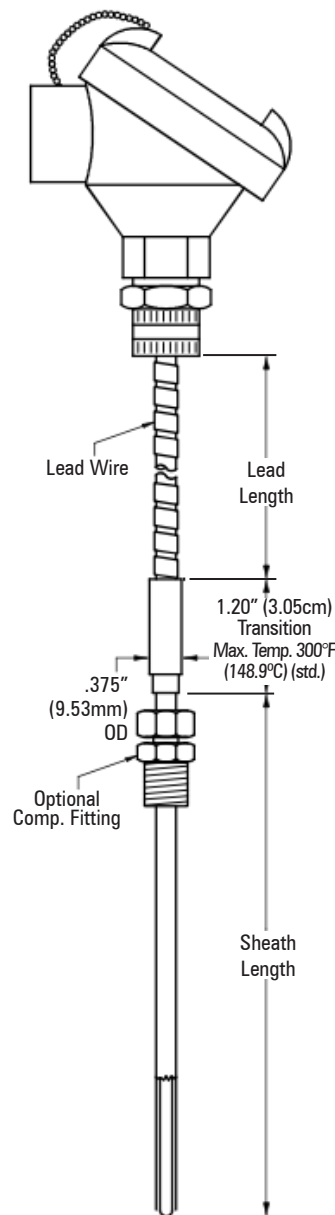
HEAD TYPE	
0	No Head
CA	Cast Aluminum
CI	Cast Iron
CSS	Cast Stainless Steel
PPS	Polypropylene Sanitary
FTA	Flip Top Aluminum
FTP	Flip Top Poly (white)
EPA	Explosion Proof Aluminum
EPS	Explosion Proof Stainless Steel
EHA	Explosion Proof Aluminum
EHI	Explosion Proof Iron

SENSOR TYPE	
CALIBRATION	
J	Iron Constantan®
K	Chromel® Alumel®
T	Copper Constantan®
E	Chromel® Constantan®
N	Nicrosil® Nisil®
PO	Low Temp RTD to 500°F (260°C)
PH	High Temp RTD to 900°F (482°C)
PM	Heavy Duty RTD to 900°F (482°C)

Standard RTD is a three-wire 100 ohm Platinum / .00385 Alpha. For higher temperatures ranges - consult factory. For special limits on thermocouples, repeat calibration code, i.e. JJ.

OD	
18	1/8" (3.2 mm)
316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
516	5/16" (7.9 mm)
38	3/8" (9.5 mm)

JUNCTION	
G	Grounded
U	Ungrounded
E	Exposed
DG	Dual Grounded
DU	Dual Ungrounded
DE	Dual Exposed
S	Single RTD
D	Dual RTD



SHEATH MATERIALS	
P	304SS
R	316SS
Q	310SS
A	Alloy 600
Standard Sheath Material is 316SS.	

LEAD WIRE	
F	Fiberglass
T	Teflon®
P	PVC
PS	PVC Shielded
MF	Multi Strand (flexible) Fiberglass (RTD std.)
MT	Multi Strand (flexible) Teflon® (RTD std.)

OPTIONS	
SENSOR	
A	Armor (Stainless Steel)
AP	Armor with PVC Jacket
CG12	Cord Grip, 1/2" NPT
SS18	Adj SS Comp Fitting 1/8" NPT*
SS14	Adj SS Comp Fitting 1/4" NPT*
SS12	Adj SS Comp Fitting 1/2" NPT*
BR18	Adj Brass Comp Fitting 1/8" NPT*
BR14	Adj Brass Comp Fitting 1/4" NPT*
BR12	Adj Brass Comp Fitting 1/2" NPT*
VH	Vent hole for fittings
TA	Tube on Armor, 1/4" (6.4 mm) OD x 2" (50.8 cm) long
TAC	Tube on Armor with SS12 Fitting for Head Mount
SA12	Spring Assembly with Hex Fitting, 1/2" NPT
SB	Stainless Steel Overbraid on Lead Wire
HV	High Vibration RTD (PM only)
CR	Cryogenic RTD (PM only)
CT	Compensated Terminals (EHA/EHI head only)
WP	Weld Pad
FW	Four Wire RTD
GA	Class A
*Add T after SS or BR for Teflon® Ferrule	

TRANSMITTER/INDICATOR	
LCP	Programmable, RTD, FM
PT	Programmable FM
HC	Hart® Compatible
Provide Range and Temp F/C	
LPI	Loop Temperature Indicator
BPI	Battery Powered Indicator

See pages 24-28 for additional sensor, transmitter and indicator options.

The thermocouple and RTD designs for these sensors are multi-purpose but all can be easily installed in an existing thermowell. All thermocouples are made with high purity mineral oxide insulation and a high temperature stainless steel sheath. RTD's are selected by determining the temperature range and vibration considerations. The 1440 has a sealed weld connection preventing hot gases from escaping and consequently can be used without a thermowell. The 1443 is designed specifically for use in a thermowell and comes with a spring assembly which insures positive contact to the bottom of the well and provides good response characteristics. The 1445 eliminates the need for an exact immersion length. The 1450 is a sealed weld connection and the 1455 is adjustable with compression fitting. Tube well assemblies come with 0.020" (0.508 mm) wall tube and a replaceable spring loaded sensor made to fit the tube I.D.

HEAD TYPE

O	No Head
CA	Cast Aluminum
CI	Cast Iron
CSS	Cast Stainless Steel
PPS	Polypropylene Sanitary
FTA	Flip Top Aluminum
FTP	Flip Top Poly (white)
EPA	Explosion Proof Aluminum
EPS	Explosion Proof Stainless Steel
EHA	Explosion Proof Aluminum

SENSOR/TUBEWELL TYPE

SENSOR	TUBEWELL
1440	1450
1443	1455
1445	

CALIBRATION

J	Iron Constantan®
K	Chromel® Alumel®
T	Copper Constantan®
E	Chromel® Constantan®
N	Nicrosil® Nisil®
PO	Low Temp RTD to 500°F (260°C)
PH	High Temp RTD to 900°F (482°C)
PM	Heavy Duty RTD to 900°F (482°C)

Standard RTD is a three-wire 100 ohm Platinum / 0.00385 Alpha. For higher temperature ranges - consult factory. For special limits on thermocouples, repeat calibration code, i.e. JJ.

OD

Sensor	OD
18	1/8" (3.2 mm)
316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
516	5/16" (7.9 mm)
38	3/8" (9.5 mm)

TubeWell

316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
516	5/16" (7.9 mm)
38	3/8" (9.5 mm)

JUNCTION

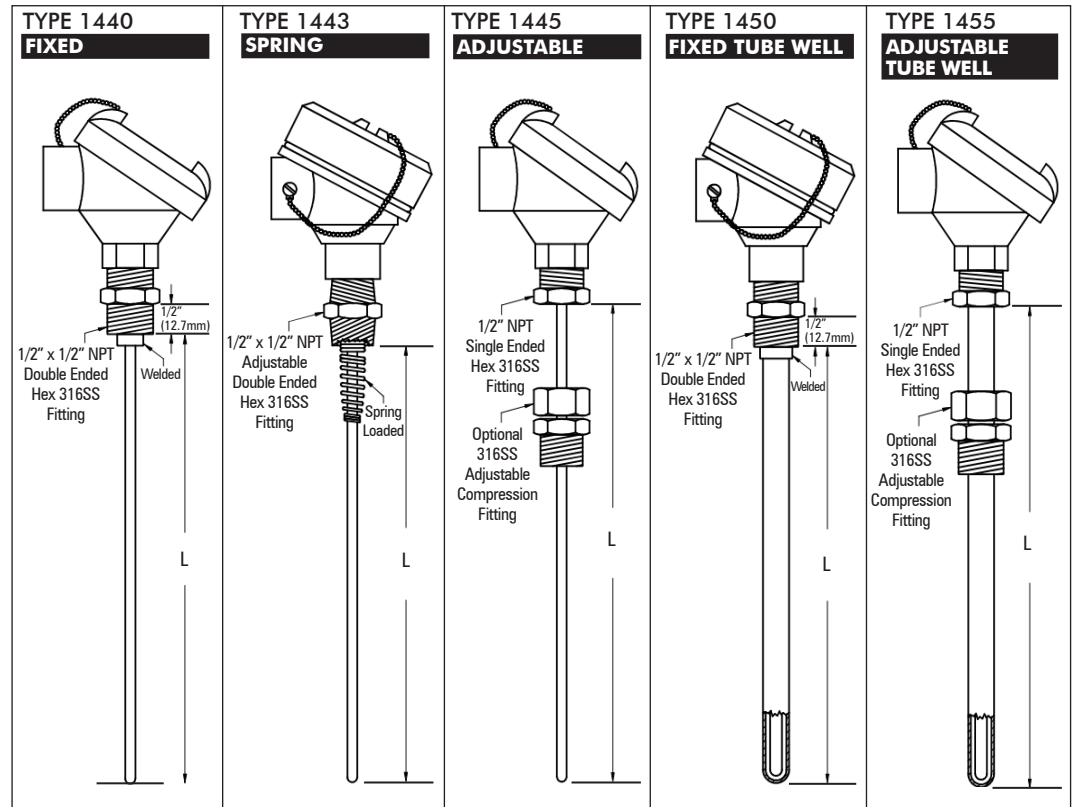
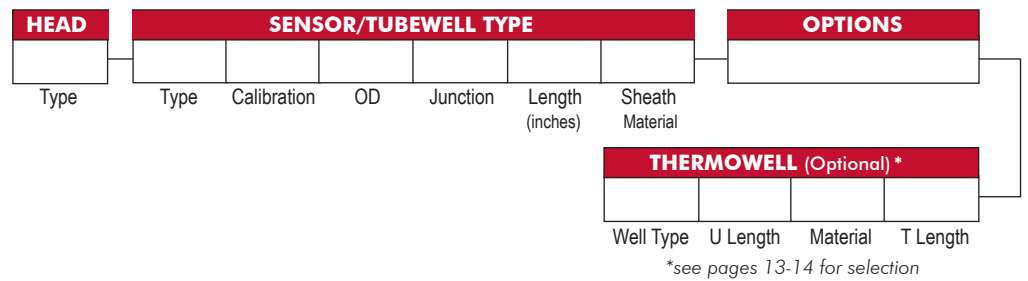
G	Grounded
U	Ungrounded
DG	Dual Grounded
DU	Dual Ungrounded
S	Single RTD
D	Dual RTD

SHEATH MATERIALS

P	304SS	Q	310SS
R	316SS	A	Alloy 600

Standard Sheath Material is 316SS.

To order indicate a code/value for each component.



OPTIONS

OPTION	DESCRIPTION
BR18	Adj Brass Comp Fitting 1/8" NPT*
BR14	Adj Brass Comp Fitting 1/4" NPT*
BR12	Adj Brass Comp Fitting 1/2" NPT*
CT	Compensated Terminals (EHA/EHI head only)
FW	Four Wire RTD
GA	Class A

SENSOR

HV	High Vibration (PM RTDs only)
SS18	Adj SS Comp Fitting 1/8" NPT*
SS14	Adj SS Comp Fitting 1/4" NPT*
SS12	Adj SS Comp Fitting 1/2" NPT*
TW	Two Wire RTD
VH	Vent hole for fittings insert following fitting part no.

*Add T after SS or BR for Teflon® Ferrule

TRANSMITTER/INDICATOR

HC	Hart® Compatible
LCP	Programmable, RTD
PT	Programmable
	Provide Range and Temp F/C
BPI	Battery Powered Indicator
LPI	Loop Temperature Indicator

See pages 24-28 for additional sensor, transmitter and indicator options.

To order indicate a code/value for each component.

- If you do not need a flange, leave those boxes blank.
- To order only a thermowell complete just those boxes. To add a nipple or nipple-union-nipple also include the extension code and "A" length.
- Additional information is provided throughout the catalog to help you configure the type of assembly you need.

UNIT			THERMOWELL				SENSOR TYPE				FLANGE (Optional)			OPTIONS
Head Type	Extension	A Length (inches)	Well Type	U Length (inches)	Material	T Length	Calibration	OD	Junction	Sheath	Size	Rating	Type	

UNIT	
HEAD TYPE	
0	No Head
CA	Cast Aluminum
CI	Cast Iron
CSS	Cast Stainless Steel
FTA	Flip Top Aluminum
FTP	Flip Top Poly (white)
EPA	Explosion Proof Aluminum
EPS	Explosion Proof Stainless Steel
EHA	Explosion Proof Aluminum
EHI	Explosion Proof Iron
PPS	Polypropylene Sanitary

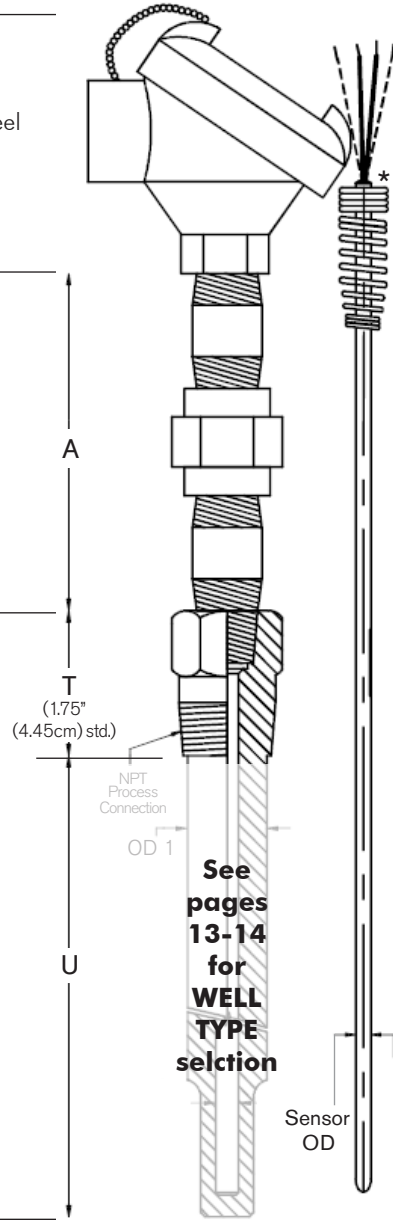
See pages 18-19 for additional details.

EXTENSION	
N	Nipple Galvanized
NUN	Nipple/Union/Nipple Galvanized
NS	Nipple Stainless Steel
NUNS	Nipple/Union/Nipple Stainless Steel
HUNS	Hex Nipple/Union/Nipple Stainless Steel
PNUN	Pressure Seal in Union Galvanized
PNUNS	Pressure Seal in Union Stainless Steel

See page 20 for additional details.

THERMOWELL (Optional)	
WELL TYPE - See pages 13-14 to select	
WELL MATERIAL - See page 24 for additional materials	
A	Alloy 600
AA	Alloy 20
B	Hastelloy® B
C	Hastelloy® C
D	321SS
F	347SS
H	446SS
I	Alloy 800
LP	Low Carbon 304SS
LR	Low Carbon 316SS
M	Monel® 400
N	Nickel
P	304SS
Q	310SS
R	316SS
S	Carbon Steel
T	Teflon®
V	Alloy 825
W	Alloy 601
Y	Brass

FLANGE (Optional)		
FLANGE SIZE	FLANGE RATING	FLANGE TYPE
1" (2.54 cm)	150 600	FF Flat Face
1 1/2" (3.81 cm)	200 900	RF Raised Face
2" (5.08 cm)	300 1500	RTJ Ring Type Joint
3" (7.62 cm)	400	
4" (10.16 cm)		



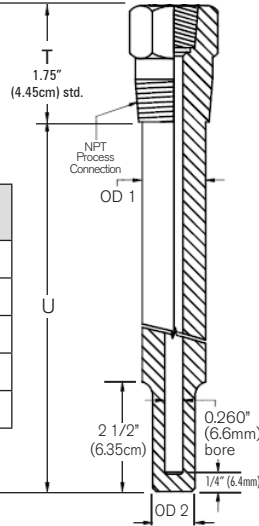
SENSOR TYPE	
CALIBRATION	
J	Iron Constantan®
K	Chromel® Alumel®
T	Copper Constantan®
E	Chromel® Constantan®
N	Nicrosil® Nisil®
PO	Low Temp RTD to 500°F (260°C)
PH	High Temp RTD to 900°F (482°C)
PM	Heavy Duty RTD to 900°F (482°C)
Standard RTD is a three-wire 100 ohm Platinum / 0.00385 Alpha. For higher temperature ranges - consult factory. For special limits on thermocouples, repeat calibration code, i.e. JJ.	
OD	
18	1/8" (3.2 mm)
316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
516	5/16" (7.9 mm)
38	3/8" (9.5 mm)
JUNCTION	
G	Grounded
U	Ungrounded
E	Exposed
DG	Dual Grounded
DU	Dual Ungrounded
DE	Dual Exposed
S	Single RTD
D	Dual RTD
SHEATH MATERIALS	
P	304SS
R	316SS
Q	310SS
A	Alloy 600
Standard Sheath Material is 316SS.	
* Epoxy Seal - Max. Temp. 300°F (149°C)	

OPTIONS		THERMOWELL		TRANSMITTER/INDICATOR	
SENSOR		BC	Brass Plug and Chain	TF	Teflon® Coating
CR	Cryogenic RTD (PM only)	FP	Full Penetration Weld	RB	0.130" (3.3 mm) Bore
CT	Compensated Terminals (EHA/EHI head only)	HTE	Hydrostatic Pressure Test External	SC	SS Plug and Chain
FW	Four Wire RTD	HTI	Hydrostatic Pressure Test Internal	ST	Stellite® Coating
GA	Class A	NC	NACE Certification for Well	VC	Velocity Calculations
HV	High Vibration RTD (PM only)	OC	Oxygen Cleaned	WB	0.385" (9.8 mm) Bore
		TC	Tungsten Carbide		Other Bore sizes available, consult factory.
				BPI	Battery Powered Indicator
				HC	Hart® Compatible
					Provide Range and Temp F/C
				LCP	Programmable, RTD
				LPI	Loop Temperature Indicator
				PT	Programmable

See pages 24-28 for additional sensor, thermowell, transmitter and indicator options.

STEP-DOWN THREADED

Type	NPT Process	OD1	OD2
SR	1/2"	5/8" (15.9 mm)	1/2" (12.7 mm)
SR0	3/4"	3/4" (19.1 mm)	1/2" (12.7 mm)
SR1	1"	7/8" (22.2 mm)	1/2" (12.7 mm)
SR2	1 1/4"	1 1/8" (28.6 mm)	3/4" (19.1 mm)
SR3	1 1/2"	1 1/8" (28.6 mm)	3/4" (19.1 mm)

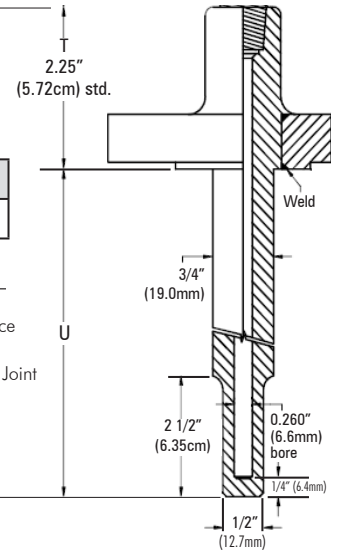


STEP-DOWN FLANGED

Type	Description
FR	Step-down Flanged

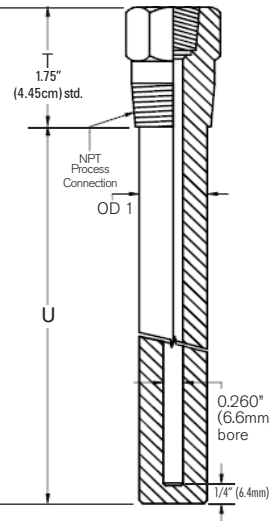
FLANGE

SIZE	RATING	TYPE
1" (2.54 cm)	150	RF Raised Face
1 1/2" (3.81 cm)	200	FF Flat Face
2" (5.08 cm)	300	RTJ Ring Type Joint
3" (7.62 cm)	400	
4" (10.16 cm)	600	
	900	
	1500	



STRAIGHT THREADED

Type	Process NPT	OD1
SS	1/2"	0.680" (17.3 mm)
SS0	3/4"	3/4" (19.1 mm)
SS1	1"	7/8" (22.2 mm)
SS2	1 1/4"	1 1/8" (28.6 mm)
SS3	1 1/2"	1 1/8" (28.6 mm)

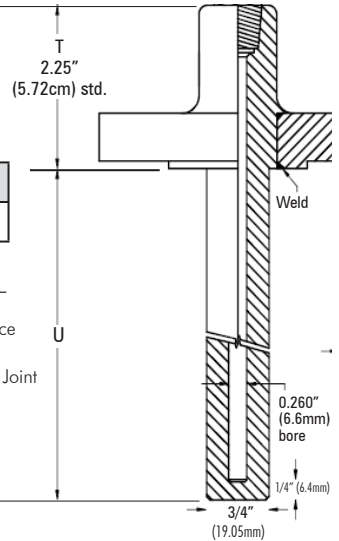


STRAIGHT FLANGED

Type	Description
FS	Straight Flanged

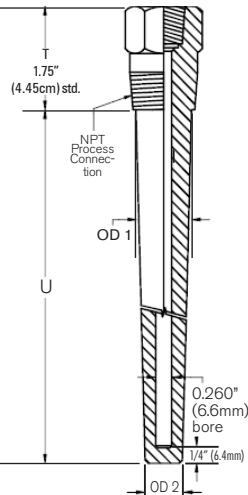
FLANGE

SIZE	RATING	TYPE
1" (2.54 cm)	150	RF Raised Face
1 1/2" (3.81 cm)	200	FF Flat Face
2" (5.08 cm)	300	RTJ Ring Type Joint
3" (7.62 cm)	400	
4" (10.16 cm)	600	
	900	
	1500	



TAPERED THREADED

Type	NPT Process	OD1	OD2
ST	1/2"	0.680" (17.3 mm)	5/8" (15.9 mm)
ST0	3/4"	7/8" (22.2 mm)	5/8" (15.9 mm)
ST1	1"	1 1/16" (26.0 mm)	5/8" (15.9 mm)
ST2	1 1/4"	1 1/8" (28.6 mm)	3/4" (19.1 mm)
ST3	1 1/2"	1 1/8" (28.6 mm)	3/4" (19.1 mm)



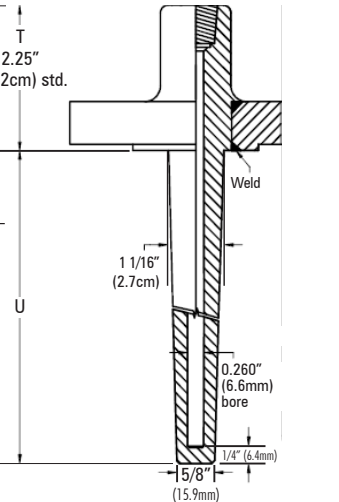
TAPERED FLANGED

Type	Description
FT	Tapered Flanged

FLANGE

SIZE	RATING	TYPE
1"* (2.54 cm)	150	RF Raised Face
1 1/2" (3.81 cm)	200	FF Flat Face
2" (5.08 cm)	300	RTJ Ring Type Joint
3" (7.62 cm)	400	
4" (10.16 cm)	600	
	900	
	1500	

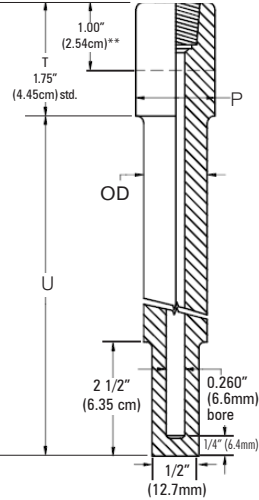
* Major OD is 7/8" (22.2 mm) for flange sizes 1" (25.4 mm) and smaller.



STEP-DOWN SOCKET

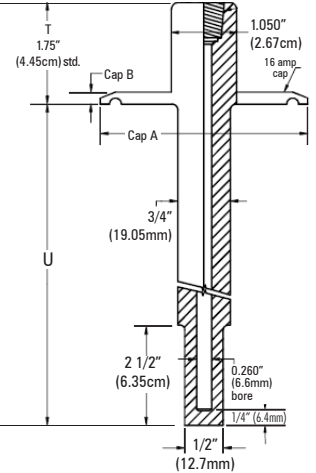
Type	NPT Process	Actual Diameter (P)	OD 1
SWR**	1/2"	0.840" (21.2 mm)	0.680" (17.3mm)
SWRO	3/4"	1.050" (26.7 mm)	0.75" (19.01 mm)
SWR1	1"	1.315" (33.4 mm)	0.875" (22.2 mm)

Note: To fit 3,000 lbs (1360.78 kg) coupling.
** Instrument connection equals 1.062" (2.7 cm) OD



SANITARY

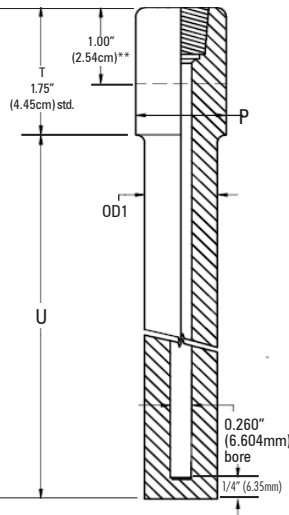
Type	NPT Process	Cap A	Cap B
SA10	1"	0.992" (2.52 cm)	0.200" (5.1 mm)
SA15	1 1/2"	1.984" (5.04 cm)	0.250" (6.4 mm)
SA20	2"	2.516" (6.39 cm)	0.250" (6.4 mm)
SA25	2 1/2"	3.047" (7.74 cm)	0.250" (6.4 mm)
SAT30	3"	3.579" (9.09 cm)	0.250" (6.4 mm)
SAT40	4"	4.682" (11.89 cm)	0.312" (7.9 mm)



STRAIGHT SOCKET

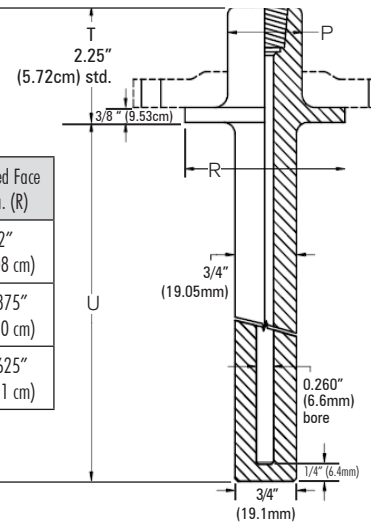
Type	NPT Process	Actual Diameter (P)	OD 1
SWS**	1/2"	0.84" (21.226 mm)	0.680" (17.272 mm)
SWS0	3/4"	1.05" (26.67 mm)	0.75" (19.05 mm)
SWS1	1"	1.315" (33.40 mm)	0.875" (22.225 mm)

Note: To fit 3,000 lbs (1360.78 kg) coupling.
** Instrument connection equals 1.062" (2.70 cm) OD



VAN STONE

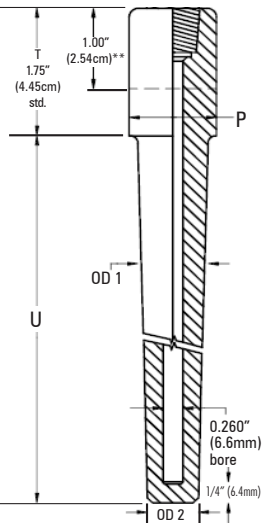
Type	NPT Process	Actual Dia. (P)	Raised Face Dia. (R)
VS1	1"	1.315" (3.34 cm)	2" (5.08 cm)
VS3	1 1/2"	1.900" (4.83 cm)	2.875" (7.30 cm)
VS4	2"	2.375" (6.03 cm)	3.625" (9.21 cm)



TAPERED SOCKET

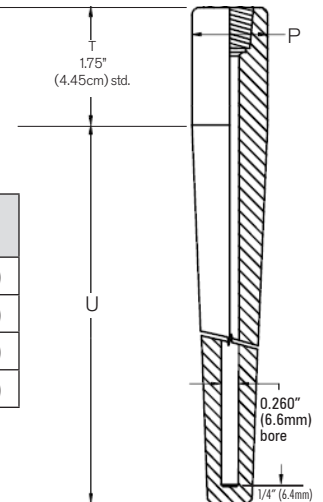
Type	NPT Process	Actual Diameter (P)	OD 1	OD2
SWT**	1/2"	0.840" (21.2mm)	0.680" (17.3 mm)	0.625" (15.9 mm)
SWT0	3/4"	1.050" (26.7 mm)	0.750" (19.05 mm)	0.625" (15.9 mm)
SWT1	1"	1.315" (33.4 mm)	1.00" (25.4 mm)	0.625" (15.9 mm)
SWT2	1 1/4"	1.66" (42.2 mm)	1.125" (28.56 mm)	0.75" (19.1 mm)
SWT3	1 1/2"	1.90" (48.3 mm)	1.375" (34.9 mm)	0.875" (22.2 mm)
SWT4	2"	2.375" (60.3 mm)	1.75" (44.5 mm)	1.250" (31.8 mm)

Note: To fit 3,000 lbs (1360.78 kg) coupling.
** Instrument connection equals 1.062" (2.7 cm) OD



WELD IN

Type	NPT Process	Actual Diameter (P)
WD0	3/4"	1.050" (2.67 cm)
WD1	1"	1.315" (3.34 cm)
WD2	1 1/4"	1.660" (4.22 cm)
WD3	1 1/2"	1.900" (4.83 cm)



(D=5/8" (15.8 mm) - 0.260 Bore) (D=3/4" (19.1 mm) - 0.385 (9.8 mm Bore)

Temperature Sensors

Pipe Well Assemblies

To order indicate a code/value for each component.

- If you do not need a flange, leave those boxes blank.
- To order only a thermowell complete just those boxes. To add a nipple or nipple-union-nipple also include the extension code and "A" length.
- Additional information is provided throughout the catalog to help you configure the type of assembly you need.

UNIT			PIPE WELL			SENSOR TYPE				FLANGE			OPTIONS
Head Type	Extension	A Length (inches)	Pipe Type	U Length (inches)	Material	Calibration	OD	Junction	Sheath	Size	Rating	Type	

UNIT

HEAD TYPE

0	No Head	FTP	Flip Top Poly (white)
CA	Cast Aluminum	EPA	Explosion Proof Aluminum
CI	Cast Iron	EPS	Explosion Proof Stainless Steel
CSS	Cast Stainless Steel	EHA	Explosion Proof Aluminum
PPS	Polypropylene Sanitary	EHI	Explosion Proof Iron
FTA	Flip Top Aluminum		

See page 18-19 for additional details.

EXTENSION

0	None
NU	Nipple/Union Galvanized
NUS	Nipple/Union Stainless Steel

See page 33 for additional information.

THERMOWELL

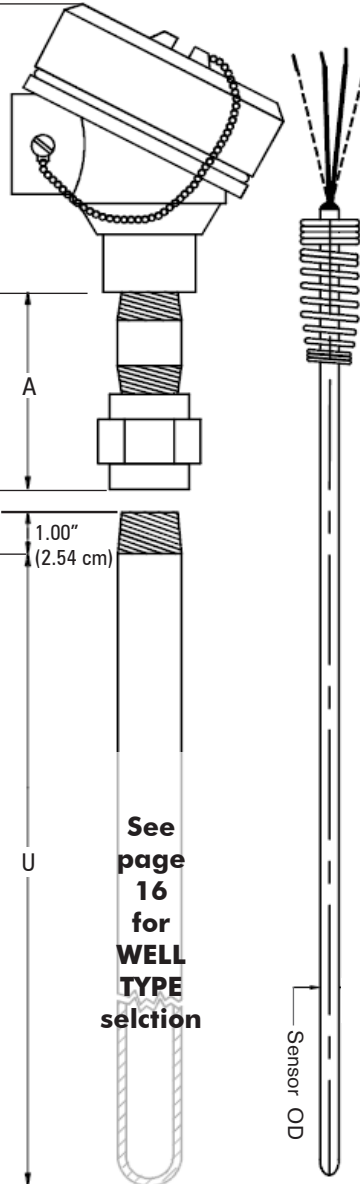
PIPE TYPE - See page 16 to select

WELL MATERIAL - See page 24 for additional materials.

A	Alloy 600	M	Monel® 400
AA	Alloy 20	N	Nickel
B	Hastelloy® B	P	304SS
C	Hastelloy® C	Q	310SS
D	321SS	R	316SS
F	347SS	S	Carbon Steel
H	446SS	T	Teflon®
I	Alloy 800	V	Alloy 825
LP	Low Carbon 304SS	W	Alloy 601
LR	Low Carbon 316SS	Y	Brass

FLANGE

FLANGE SIZE	FLANGE RATING	FLANGE TYPE
1" (2.54 cm)	150 600	FF Flat Face
1 1/2" (3.81 cm)	200 900	RF Raised Face
2" (5.08 cm)	300 1500	RTJ Ring Type Joint
3" (7.62 cm)	400	
4" (10.16 cm)		



See page 16 for WELL TYPE selection

SENSOR TYPE

CALIBRATION

J	Iron Constantan®
K	Chromel® Alumel®
T	Copper Constantan®
E	Chromel® Constantan®
N	Nicrosil® Nisil®
PO	Low Temp RTD to 500°F (260°C)
PH	High Temp RTD to 900°F (482°C)
PM	Heavy Duty RTD to 900°F (482°C)

Standard RTD is a three-wire 100 ohm Platinum / 0.00385 Alpha. For higher temperature ranges - consult factory. For special limits on thermocouples, repeat calibration code, i.e. JJ.

OD

316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
516	5/16" (7.9 mm)
38	3/8" (9.5 mm)

JUNCTION

G	Grounded
U	Ungrounded
E	Exposed
DG	Dual Grounded
DU	Dual Ungrounded
DE	Dual Exposed
S	Single RTD
D	Dual RTD

SHEATH MATERIALS

P	304SS
R	316SS
Q	310SS
A	Alloy 600

Standard Sheath Material is 316SS.
* Epoxy Seal - Max. Temp. 300°F (149°C)

OPTIONS

SENSOR

CR	Cryogenic RTD (PM only)
CT	Compensated Terminals (EHA/EHI head only)
FW	Four Wire RTD
HV	High Vibration RTD (PM only)
GA	Class A

THERMOWELL

FP	Full Penetration Weld
HTE	Hydrostatic Pressure Test External
HTI	Hydrostatic Pressure Test Internal
NC	NACE Certification for Well
OC	Oxygen Cleaned
SH	Schedule 80

ST	Stellite® Coating
SX	Schedule 160
SXX	Double Extra Heavy
TC	Tungsten Carbide
TF	Teflon® Coating

TRANSMITTER/INDICATOR

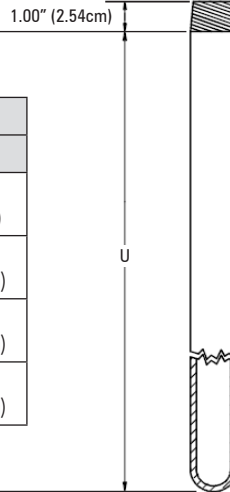
BPI	Battery Powered Indicator
HC	Hart® Compatible
	Provide Range and Temp F/C
LCP	Programmable, RTD
LPI	Loop Temperature Indicator
PT	Programmable

See page 24-28 for additional sensor, thermowell, transmitter and indicator options.

PIPE

Type*	Pipe Size	OD	ID			
			SCH40	SCH80	SCH 160	XXH
PW	1/2" NPT	0.840" (21.8 mm)	0.622" (15.8 mm)	0.546" (13.9 mm)	0.466" (11.8 mm)	0.252" (6.4 mm)
PW0	3/4" NPT	1.050" (26.8 mm)	0.824" (20.9 mm)	0.742" (18.9 mm)	0.614" (15.6 mm)	0.434" (11.0 mm)
PW1	1" NPT	1.315" (33.4 mm)	1.049" (26.6 mm)	0.957" (24.3 mm)	0.815" (20.7 mm)	0.599" (15.2 mm)
PW2	1 1/4" NPT	1.660" (42.2 mm)	1.380" (35.1 mm)	1.278" (32.5 mm)	1.160" (29.5 mm)	0.896" (22.8 mm)

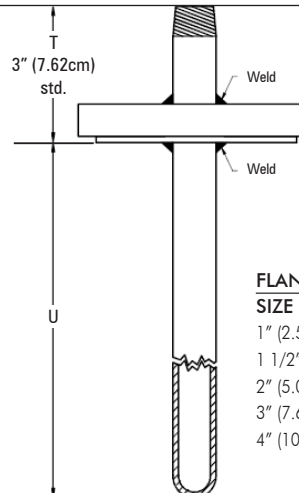
* Schedule 40 is standard. See options for other schedules.



FLANGED PIPE

Type*	Pipe Size	OD	ID			
			SCH40	SCH80	SCH 160	XXH
FPW	1/2" NPT	0.840" (21.8 mm)	0.622" (15.8 mm)	0.546" (13.9 mm)	0.466" (11.8 mm)	0.252" (6.4 mm)
FPW0	3/4" NPT	1.050" (26.8 mm)	0.824" (20.9 mm)	0.742" (18.9 mm)	0.614" (15.6 mm)	0.434" (11.0 mm)
FPW1	1" NPT	1.315" (33.4 mm)	1.049" (26.6 mm)	0.957" (24.3 mm)	0.815" (20.7 mm)	0.599" (15.2 mm)
FPW2	1 1/4" NPT	1.660" (42.2 mm)	1.380" (35.1 mm)	1.278" (32.5 mm)	1.160" (29.5 mm)	0.896" (22.8 mm)

*Flanges made from same material as pipe. Schedule 40 is standard. See options for other schedules.



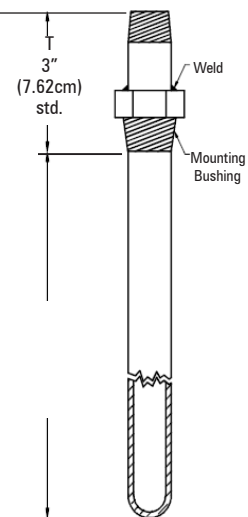
FLANGE

SIZE	RATING	TYPE
1" (2.54 cm)	150	RF Raised Face
1 1/2" (3.81 cm)	200	FF Flat Face
2" (5.08 cm)	300	RTJ Ring Type Joint
3" (7.62 cm)	400	
	600	
4" (10.16 cm)	900	
	1500	

THREADED PIPE

Type*	Pipe Size	OD	ID				Std. Mounting Bushing**
			SCH40	SCH80	SCH 160	XXH	
SPW	1/2" NPT	0.840" (21.8 mm)	0.622" (15.8 mm)	0.546" (13.9 mm)	0.466" (11.8 mm)	0.252" (6.4 mm)	3/4" (19.1 mm), 1" (25.4 mm), 1 1/4" (31.8 mm), 1 1/2" (38.1 mm)
SPW0	3/4" NPT	1.050" (26.8 mm)	0.824" (20.9 mm)	0.742" (18.9 mm)	0.614" (15.6 mm)	0.434" (11.0 mm)	1" (25.4 mm), 1 1/4" (31.8 mm), 1 1/2" (38.1 mm), 2" (50.8 mm)
SPW1	1" NPT	1.315" (33.4 mm)	1.049" (26.6 mm)	0.957" (24.3 mm)	0.815" (20.7 mm)	0.599" (15.2 mm)	1 1/4" (31.8 mm), 1 1/2" (38.1 mm), 2" (50.8 mm), 2 1/2" (63.5 mm)
SPW2	1 1/4" NPT	1.660" (42.2 mm)	1.380" (35.1 mm)	1.278" (32.5 mm)	1.160" (29.5 mm)	0.896" (22.8 mm)	2" (50.8 mm), 2 1/2" (63.5 mm)

* Schedule 40 is standard. See options for other schedules.
** Bushing will be 304SS unless otherwise noted.



Mullite and Alumina Tubes

Alumina tubes are 98% pure alumina oxide and can be used with all thermocouple calibrations including noble metals. Good general purpose use. Use for all atmospheres with temperature rating of 3400°F (1,871°C). Has fair resistance to thermal shock.

Mullite is preferred for oxidizing atmospheres and can not be used with noble metal thermocouples. Maximum temperature rating is 3000°F (1,648°C). Both Mullite and Alumina should be heated prior to process insertion.

Hexoloy® Tubes

Excellent abrasion resistance and high resistance to thermal shock, also has good thermal conductivity (3 times greater than stainless steel). Due to its toughness it can be used in high pressure and velocity environments. Maximum temperature rating is 2900°F (1,593°C).

To order indicate a code/value for each component.
If you only need a protection tube, fill in just those boxes.

UNIT			TUBE TYPE			
Head Type	Extension	A Length (inches)	Tube Type	U Length (inches)	Material	Connection

MI CABLE			
Calibration	OD	Junction	A Sheath

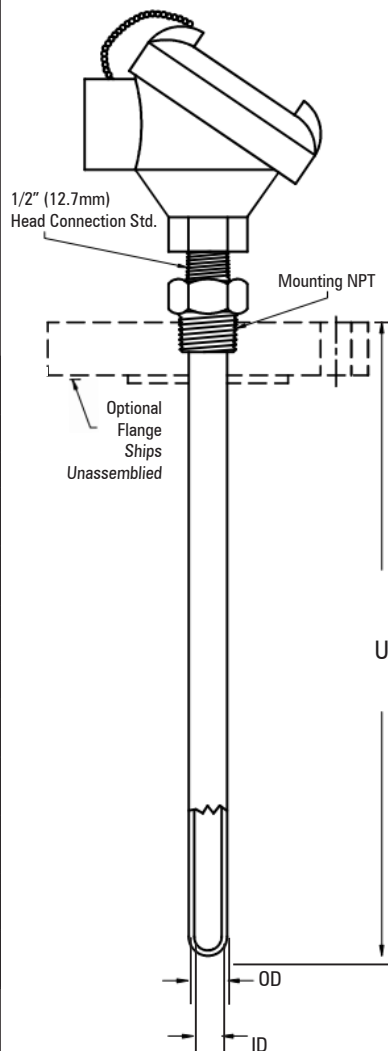
UNPROTECTED T/C	
Type	Calibration

UNIT	
HEAD TYPE	
0 No Head	FTP Flip Top Poly (white)
CA Cast Aluminum	EPA Explosion Proof Aluminum
CI Cast Iron	EPS Explosion Proof Stainless Steel
CSS Cast Stainless Steel	EHA Explosion Proof Aluminum
PPS Polypropylene Sanitary	EHI Explosion Proof Iron
FTA Flip Top Aluminum	
EXTENSION	
0 None	
NU Nipple/Union Galvanized	
NUS Nipple/Union Stainless Steel	

See page 20 for additional information.

TUBE TYPE							
Type	ID	OD	PROCESS CONNECTIONS NPT (inches)				
			1/2	3/4	1	1 1/4	1 1/2
Mullite and Alumina							
CP1	0.250" (6.4 mm)	0.375" (9.5 mm)	X	X	X	X	X
CP2	0.437" (11.1 mm)	0.687" (17.5 mm)		X	X	X	X
CP3	0.625" (15.9 mm)	0.875" (22.2 mm)			X	X	X
Hexoloy®* Hexoloy® w/Alumina							
CP5	0.250" (6.4 mm)	0.375" (9.5 mm)	X	X	X	X	X
CP6	0.375" (9.5 mm)	0.625" (15.9 mm)		X	X	X	X
CP7	0.500" (12.7 mm)	0.750" (19.1 mm)			X	X	X
CP8	0.500" (12.7 mm)	1.00" (25.4 mm)				X	X
CP9	0.750" (19.1 mm)	1.250" (31.8 mm)				X	X

STANDARD LENGTHS (U)	TUBE MATERIALS
12" (30.48 cm)	A Alumina
18" (45.72 cm)	M Mullite
24" (60.76 cm)	HX Hexoloy®*
30" (76.2 cm)	HA Hexoloy® w/Alumina
36" (91.44 cm)	Inner Tube (Plat TC)



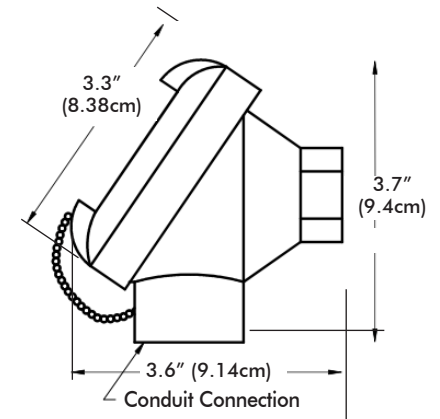
MI CABLE				
CALIBRATION				
K	Chromel® Alumel®			
N	Nicrosil® Nisil®			
R	Platinum / 13% Rhodium Pure Platinum			
S	Platinum / 10% Rhodium Pure Platinum			
B	Platinum / 30% Rhodium Platinum / 6% Rhodium			
For special limits on thermocouples, repeat calibration code, i.e. KK.				
OD				
316	3/16" (4.8 mm)			
14	1/4" (6.4 mm)			
516	5/16" (7.9 mm)			
38	3/8" (9.5 mm)			
JUNCTION				
G	Grounded			
U	Ungrounded			
E	Exposed			
DG	Dual Grounded			
DU	Dual Ungrounded			
SHEATH MATERIALS				
A	Alloy 600			
UNPROTECTED THERMOCOUPLE				
Type	Diameter		Wire Gauge	Calibration
	Single	Dual		
10	0.150" (3.8 mm)		20	K
15		0.187" (4.9 mm)	20	K
20	0.250" (6.4 mm)		14	K
25		0.313" (8.0 mm)	14	K
30	0.500" (12.7 mm)		8	K
35		0.550" (13.9 mm)	8	K
40	0.153" (3.9 mm)		24	R & S
45		0.197" (5.0 mm)	24	R & S

Universal Heads - Standard



These standard universal heads are available in polished Cast Aluminum and rugged Cast Iron. The heads are threaded and come standard with a heavy duty silicone gasket to protect against wind blown rain and dust. The gasket provides an excellent weather tight seal and meets NEMA 4X rating. Its universal construction accepts DIN size hockey puck temperature transmitters and any terminal block up to 2 inches (5.08 cm) in diameter. Standard openings are 1/2 inch NPT instrument and 3/4 inch NPT conduit. A stainless steel chain which connects the cap to the body is supplied with each head.

Order Codes CA – Cast Aluminum - NEMA 4X
CI – Cast Iron



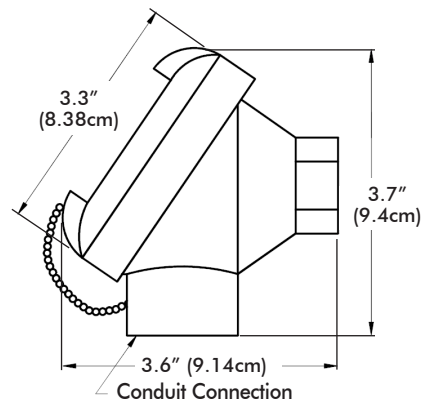
General Purpose Stainless Steel



This head has all the same characteristics as our Universal Explosion Proof stainless steel head except it has no agency approvals for use in hazardous locations. It is very effective in food processing areas where other metal heads may be affected by caustic washdowns and other CIP procedures. It is also very cost effective in process areas where aluminum can't be used.

Standard openings are 1/2 inch NPT instrument and 3/4 inch NPT conduit.

Order Code CSS – Cast Stainless Steel

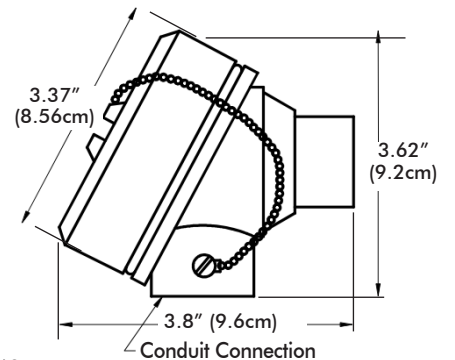


Universal Explosion Proof Heads - Standard



Head housings are available in both cast aluminum and 316 stainless steel. The heads are threaded and can accept DIN size hockey puck temperature transmitters and slightly larger sized transmitters and any terminal block up to 2 inches (5.08 cm) in diameter. The heads carry CSA, FM, ATEX and IECEx approvals. FM explosion proof rating allows the head to be used in class I, Division 1, Groups B,C, & D and Class II, Division 1, Groups E,F & G areas. Heads are also rated for NEMA 4X and IP68. Standard openings are 1/2 inch NPT instrument and 3/4 inch NPT conduit.

Order Codes EPA - Explosion Proof Aluminum - NEMA 4X, IP68
EPS - Explosion Proof Cast Stainless Steel - NEMA 4X, IP68

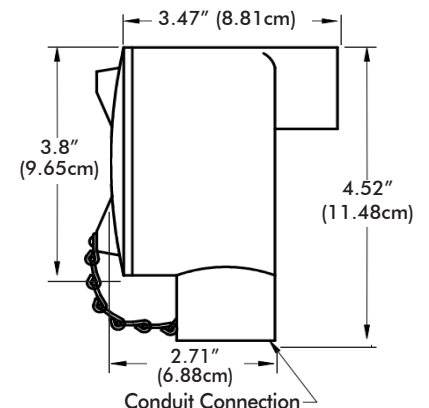


Large Universal Explosion Proof Heads

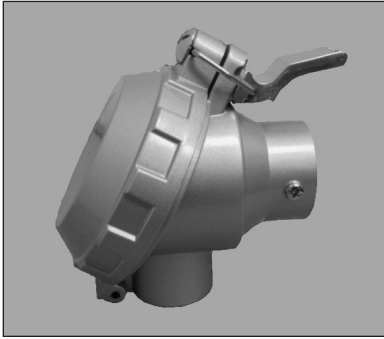


When space is not a problem this over sized, tough head is the answer. This head has all the standard features of our Universal Explosion Proof heads. Its size can accept even larger terminal blocks. The large cavity promotes faster field wiring connections and consequently reduces installation costs. To reduce errors and improve accuracy these heads can accept the TB200 terminal block. This block is available with thermocouple contacts. Standard openings are 1/2 inch NPT instrument and 3/4 inch NPT conduit.

Order Codes EHA – Explosion Proof Aluminum
EHI – Explosion Proof Cast Iron

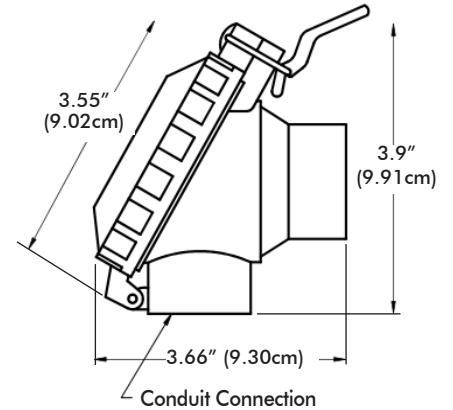


Flip Top Aluminum

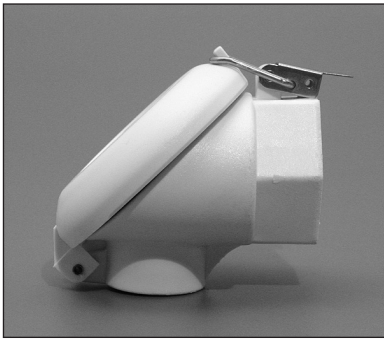


This Cast Aluminum head has no threads, therefore galling (caused by excessive heat and chemical attack) is eliminated. Thread galling may require tools to force the cap open. With the Flip Top design no tools are ever needed to open the cap and inspect or replace the sensor. Stainless hinge hardware and an O ring are standard. The head is rated for IP68 and accepts DIN size hockey puck temperature transmitters and any terminal block up to 2 inches (5.08 cm) in diameter. The cost effective aluminum design is replacing conventional threaded heads in many process plants. Standard openings are 1/2 inch NPT instrument and 3/4 inch NPT conduit.

Order Code FTA – Flip Top Aluminum - IP68

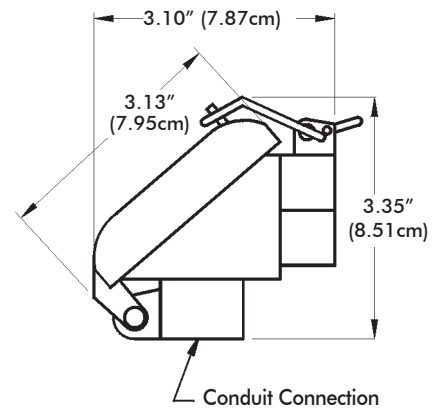


Flip Top Sanitary Head



This FDA approved plastic sanitary head has the same specifications as the FTA (flip top aluminum) head. It is NEMA 4 rated and accepts standard terminal blocks. Due to the added RFI protection a metal head provides this head is not recommended as a housing for field mounted temperature transmitters. The absence of threads in the cap and body and the FDA approved material make this head an excellent choice in food processing applications, especially where CIP caustic wash downs are used. Standard openings are 1/2 inch NPT instrument and 3/4 inch NPT conduit. Does not accommodate transmitter.

Order Code FTP – White Flip Top Sanitary

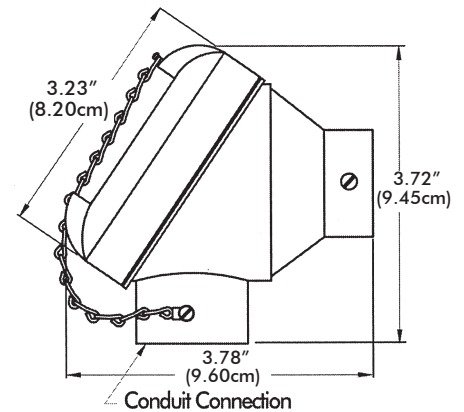


Plastic Heads



These high density plastic heads are extremely suitable for conditions that would attack conventional metal housings. The screw cover heads come standard with a neoprene rubber gasket and stainless steel chains and screws. Standard openings are 1/2 inch NPT instrument and 3/4 inch NPT conduit. Due to the added RFI protection a metal head provides this head is not recommended as a housing for field mounted temperature transmitters.

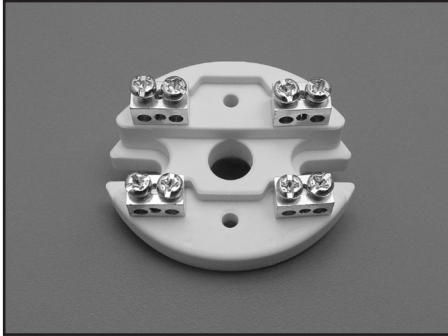
Order Code PPS – White Polypropylene Sanitary



Terminal Blocks

Our ceramic terminal block fits all special purpose and general purpose heads. It is easily field configurable for single or dual sensor applications and can be used with either thermocouples or RTDs. Its ceramic base protects against elevated temperatures and the brass contacts make it easy for field wiring. The compensated block used in EHA and EHI explosion proof heads is available with thermocouple contacts.

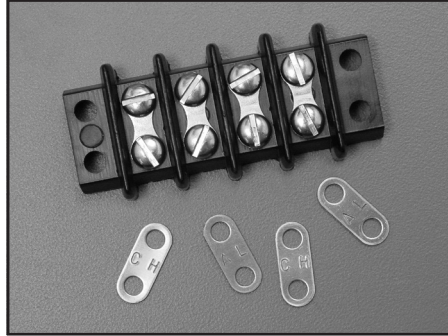
Ceramic Block



Order Codes

TB102 - Ceramic Block - Single TC
 TB103 - Ceramic Block - Single RTD
 TB104 - Ceramic Block - Dual TC
 TB106 - Ceramic Block - Dual RTD

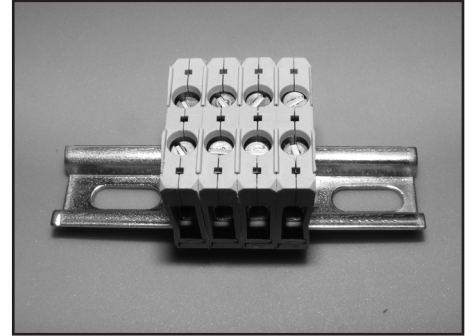
Compensated Block for EHA and EHI Heads



Order Codes

TB202 - Block - Single TC
 TB203 - Block - Single RTD
 TB204 - Block - Dual TC
 TB206 - Block - Dual RTD

Compression Block for EHA, EHI, EP Series



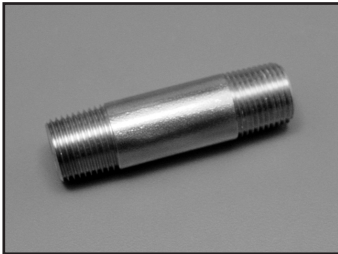
Order Codes

CB102 - Block - Single TC
 CB103 - Block - Single RTD
 CB104 - Block - Dual TC
 CB106 - Block - Dual RTD

Note: For thermocouple contacts insert calibration letter following block part number. This block can be used in a junction box and is available in a one piece construction with up to 20 points. To order follow the ordering sequence above. i.e. TB220-J is a single terminal block with 20 points for an Iron Constantan® thermocouple.

Extensions

Nipples and unions are constructed of galvanized carbon steel as a standard construction. Adding an S to the end of the order code gets you a corrosion resistant stainless steel extension. Standard extension size is 1/2" NPT.

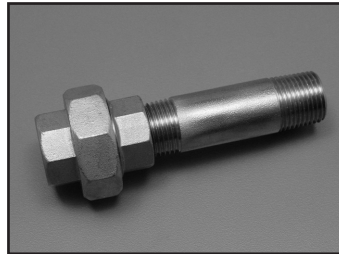


Order Codes

N Nipple
 NS Nipple - Stainless Steel

Length

1" (2.54 cm) Minimum

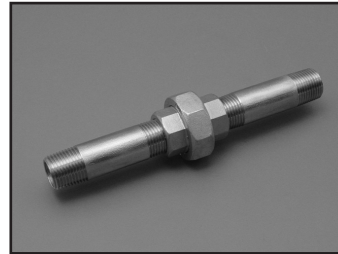


Order Codes

NU Nipple/Union
 NUS Nipple/Union - Stainless Steel

Length

2" (5.08 cm) Minimum

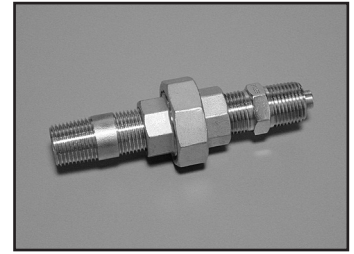


Order Codes

NUN Nipple/Union/Nipple
 NUNS Nipple/Union/Nipple - Stainless Steel
 PNUN Pressure Seal in Union - Galvanized
 PNUNS Pressure Seal in Union - Stainless Steel

Length

3" (7.62 cm) Minimum

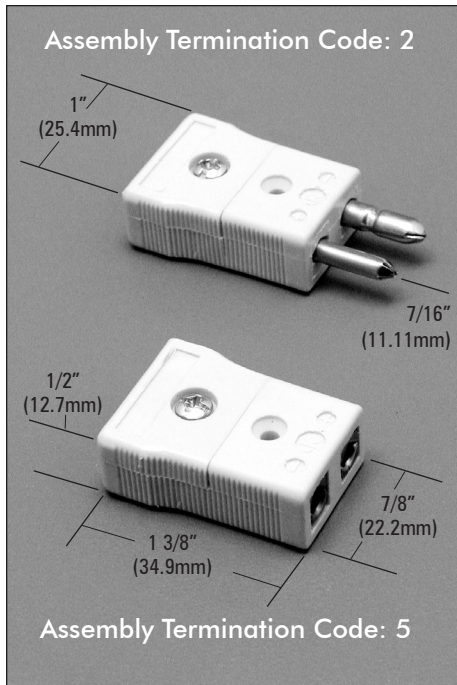


Order Code

HUNS Hex Nipple/Union/
 Nipple Stainless Steel

Length

3" (7.62 cm) Minimum

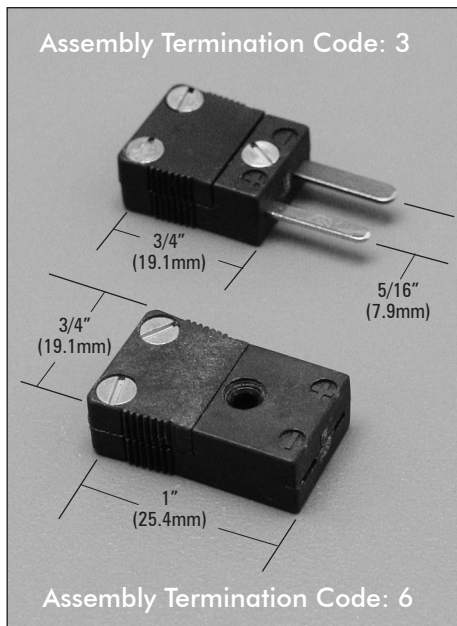


Thermocouple Connector - Two Pole

- Glass filled thermoplastic body provides high strength at temperatures up to 425°F (218°C) as well as low moisture absorption and good dielectric constant.
- Heavy duty hollow pin construction prevents reverse mating of polarity.*
- Body color coded to ISA and ANSI standards.
- Polarity indicated by symbols molded into body.
- Contacts made of thermocouple materials which meet ISA and ANSI standards.
- Jack spring loaded to insure firm grip to plug.
- Accepts wire sizes to 14 awg.
- Single screw cover cap for fast assembly.
- Accepts crimp and tube adapter for product from 0.020" (0.5 mm) to 0.375" (9.5 mm).
- Finger grips to permit ease of connection.
- Quick wiring hook up with large head screws and wire channel.

Catalog Number		Thermocouple Type	Body Color	Actual Alloy	
Plugs	Jacks			+	-
LP-J	L J-J	Iron-Constantan®	Black	Iron	Constantan®
LP-K	L J-K	Chromel®-Alumel®	Yellow	Chromel®	Alumel®
LP-E	L J-E	Chromel®-Constantan®	Violet	Chromel®	Constantan®
LP-T	L J-T	Copper-Constantan®	Blue	Copper	Constantan®
LP-R/S	L J-R/S	Platinum/Rhodium-Platinum	Green	Copper	#11 Alloy
LP-CU	L J-CU	Uncompensated	White	Copper	Copper

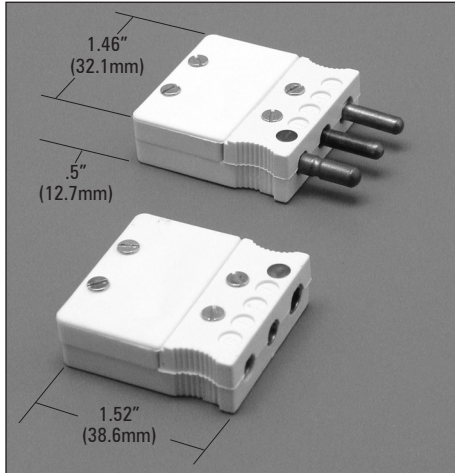
* Solid pin available on above construction. Add S to Part No. (i.e. LPS-J)



Miniature Thermocouple Connector

- Thermoplastic body provides high strength at temperatures up to 425°F (218°C) as well as low moisture absorption and good dielectric constant.
- Small, light weight and space saving.
- Body color coded to ISA and ANSI standards.
- Polarity indicated by symbols molded into body.
- Contacts made of thermocouple materials which meet ISA and ANSI standards .
- Jack spring loaded to insure firm grip to plug.
- Accepts crimp adapter for product from 0.020" (0.5 mm) to 0.125" (3.2 mm).
- Finger grips to permit ease of connection.
- 0.10" (2.54 mm) I.D. center mounting hole.

Catalog Number		Thermocouple Type	Body Color	Actual Alloy	
Plugs	Jacks			+	-
M P-J	M J - J	Iron-Constantan®	Black	Iron	Constantan®
M P- K	M J - K	Chromel®-Alumel®	Yellow	Chromel®	Alumel®
M P- E	M J - E	Chromel®-Constantan®	Violet	Chromel®	Constantan®
M P-T	M J - T	Copper-Constantan®	Blue	Copper	Constantan®
M P- R / S	M J - R / S	Platinum/Rhodium-Platinum	Green	Copper	#11 Alloy
M P- C U	M J - C U	Uncompensated	White	Copper	Copper



Three Pin Plugs and Jacks

- Body color coded to ISA and ANSI standards.
- Polarity marked.
- Negative lead clearly indicated with red disk.
- Knurled finger grip.
- Shatterproof plastic
- Temperature rating of 300°F (149°C)

Catalog Number		Thermocouple Type	Body Color	Actual Alloy + In Connector -		Ground
Plugs	Jacks					
TPP-J	TPJ-J	Iron-Constantan®	Black	Iron	Constantan®	Copper
TPP-K	TPJ-K	Chromel®-Alumel®	Yellow	Chromel®	Alumel®	Copper
TPP-E	TPJ-E	Chromel®-Constantan®	Violet	Chromel®	Constantan®	Copper
TPP-T	TPJ-T	Copper-Constantan®	Blue	Copper	Constantan®	Copper
TPP-CU	TPJ-CU	Uncompensated	White	Copper	Copper	Copper

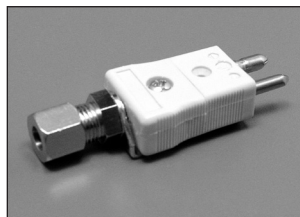
Accessories



Thermocouple Alloy Spade Lugs

Sold in bags of 25 each conductor.

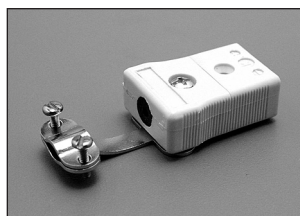
Order Code SL - _____
(thermocouple calibration)
Example: SL-K



L Bracket

For installing single metal sheath thermocouple to connector. Mounts to underside of connector for ease of wiring connections. Two screws provided for easy attachment to thermocouples.

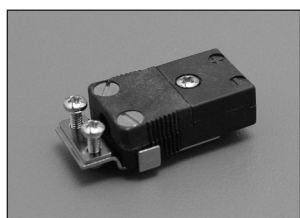
Order Code LB - _____
(Sheath OD) Example: LB-1/8"
(3.2 mm)



Wire Clamp Bracket

Rugged bracket for strain relieving insulated wires. Easily installed after wires are attached to connector.

Order Code WC



Miniature Wire Clamp Bracket

Smaller version of wire clamp bracket (above). Easily installed after wires are attached to connector.

Order Code MWC



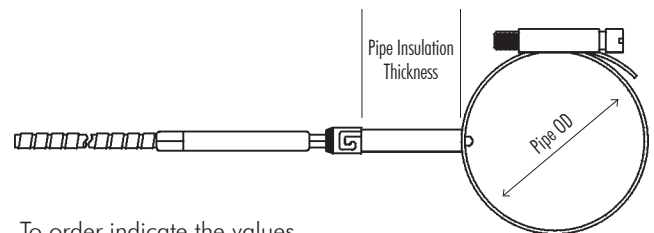
Weather Proof Jackets

Neoprene rubber jackets adds moisture protection to connection. Two per assembly.

Order Code WPJ

Pipe Clamp Adapter

Used to measure any cylindrical surface up to 36" (91.44 cm). Type PC accepts any 1100 or 1200 thermocouple with either a fixed BF or adjustable BA bayonet adapter. Be sure to add insulation thickness, if any, to overall length of thermocouple.



To order indicate the values.

PIP CLAMP ADAPTER		
PC		

Pipe Size
(inches)

Pipe Insulation
Thickness
minimum
dimension 1.5"
(38.1 mm)

Temperature Sensors

Thermocouple Extension Wire

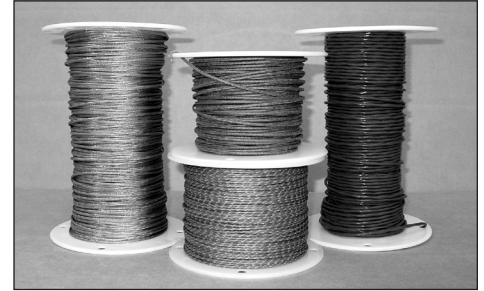
Color Coding: ANSI

Multi Strand: 16 gauge - 7 strands of 24 gage
20 gauge - 7 strands of 28 gage

Accuracy: Per ANSI MC 96.1 and ASTM E230

To Order: Specify the type number and calibration from the table below.

Example: 920-KM is fiberglass insulated and jacketed 20 gage, Chromel® Alumel® multistranded.



Type	Insulation/Jacket	Gage	Available Calibrations	Temp Rating	Construction
U716	PVC/PVC	16 Solid	JX, KX, TX, EX	221°F (105° C)	Each conductor is twisted and shielded with a drain wire added within the twist of lay. A 221°F (105°C) flame retardant PVC jacket is then applied. This construction is UL approved as 300 volt PLTC and has passed the IEEE 383 vertical flame test.
U720	PVC/PVC	20 Solid	JX, KX, TX, EX	221°F (105° C)	
720	PVC/PVC	20 Solid 20 Stranded	JX, KX, TX, EX, RX, SX JXM, KXM	221°F (105°C)	Conductors are laid parallel and jacketed. The thermocouple grade calibrations are available in both solid and multistrand. PVC has good moisture and abrasion resistance but becomes brittle at low temperatures, usually below minus 15°F (-26.1°C).
820	FEP/FEP (Teflon®)	20 Solid 20 Stranded	J, K, T JM, KM	400°F (204°C)	Conductors are laid parallel and jacketed. Teflon® has excellent resistance to moisture in temperatures down to minus 90°F (-67.8°C). This fluoropolymer has been used in many food grade applications.
824	FEP/FEP (Teflon®)	24 Solid	J, K, T	400°F (204°C)	
920	Fiberglass/Fiberglass	20 Solid 20 Stranded	J, K, T, E, RX, SX JM, KM	950°F (510°C)	Conductors are laid parallel and jacketed. Fiberglass has poor resistance to moisture and only fair abrasion resistance. A saturant is applied to facilitate easy stripping and to prevent the fiberglass from fraying.

Thermocouple Type

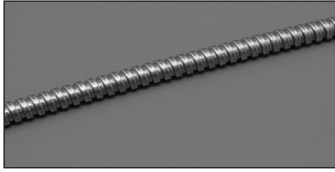
Wire Alloys	ANSI Symbol	Temperature Range		Standard Limits
		°F	°C	
Iron vs. Constantan®	J	32° to 545°	0° to +285°	±4°F (±2.22°C)
		545° to 1400°	286° to 760°	±0.75%
Chromel® vs. Alumel®	K	-165° to 32°	-109.4° to 0°	±4°F (±2.22°C)
		32° to 545°	0° to 285°	±4°F (±2.22°C)
		545° to 2300°	285° to +1260°	±0.75%
Copper vs. Constantan®	T	-330° to -85°	-201° to -65°	±1.5%
		-85° to 270°	-65° to 132°	±1.8° (±1°C)
		270° to 660°	132° to 348°	±0.75%
Chromel® vs. Constantan®	E	-330° to -270°	-201° to -167°	±1%
		-270° to 480°	-167° to -248°	±3°F (±1.67°C)
		480° to 640°	248° to 337°	±3°F (±1.67°C)
		640° to 1600°	337° to 871°	±0.5%

ANSI Color Code for Thermocouple Wire

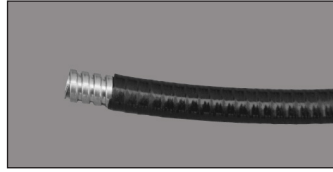
ANSI Symbol	Wire Alloys	Polarity	Thermocouple Wire Color		T/C Extension Wire Color	
			Individual	Jacket	Individual	Jacket
J	Iron	+JP	White	Brown	White	Black
	Constantan®	-JN	Red		Red	
K	Chromel®	+KP	Yellow	Brown	Yellow	Yellow
	Alumel®	-KN	Red		Red	
T	Copper	+TP	Blue	Brown	Blue	Blue
	Constantan®	-JN	Red		Red	
E	Chromel®	+EP	Purple	Brown	Purple	Purple
	Constantan®	-EN	Red		Red	

Thermocouple Extension Wire

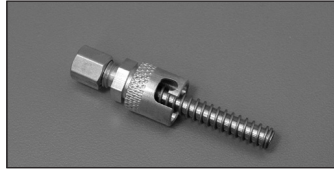
Extension Wire Alloys	ANSI Symbol	Temperature Range		Standard Limits
		°F	°C	
Iron vs. Constantan®	JX	32° to 400°	0° to 204°	±4°F (±2.22°C)
Chromel® vs. Alumel®	KX	32° to 400°	0° to 204°	±4°F (±2.22°C)
Copper vs. Constantan®	TX	-75° to 210°	-59° to 98°	±1°F (±0.56°C)
Chromel® vs. Constantan®	EX	32° to 400°	0° to 204°	±3°F (±1.67°C)



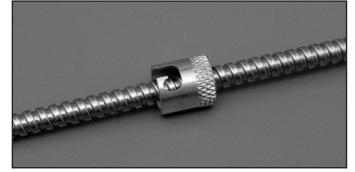
A - Armor (Stainless Steel)



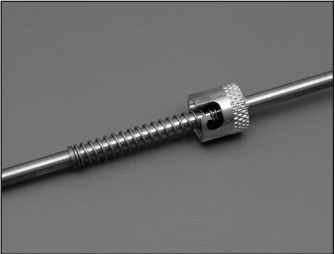
AP - Armor with PVC



BA - Bayonet Adapter



BCA - Bayonet Cap on Armor



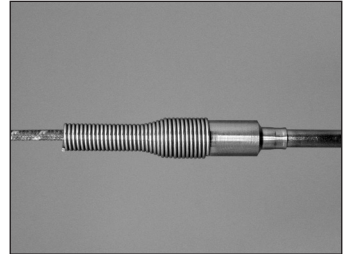
BF - Bayonet Cap and Spring



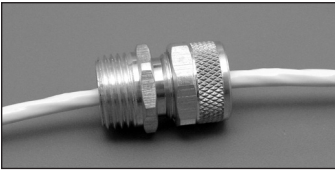
BPI - Battery Powered LCD



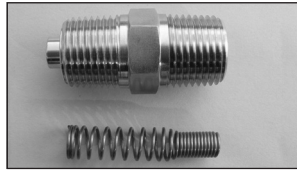
BPIX - Battery Powered Indicator Explosion Proof



BS - Bell Spring Transition Relief



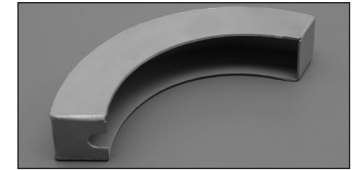
CG12 - Weather Tight Fitting



DE12 - Double Ended Hex Fitting
1/2" NPT Spring Loaded Stainless Steel



EB - Reducer Bushing for Head Conduit 3/4" to 1/2" NPT



HS - Heat Shield for Type 1510 and 1520



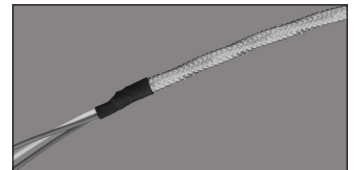
LB - Connector "L" Bracket



PMB - Plastic Melt Bolt



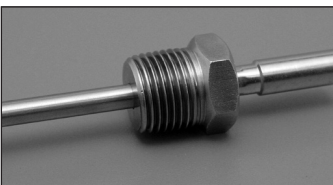
SA12 - Spring Assembly with Hex Fitting Stainless Steel



SB - Overbraid Stainless Steel



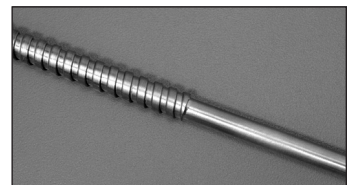
Thermowell Plug and Chain
SC - Stainless Steel
BC - Brass



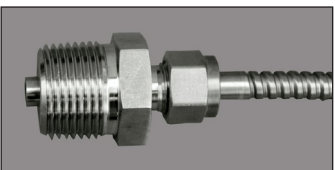
Single End Hex Fitting Stainless Steel (SE12, SE14, SE18)



ST - Smooth Transition
Red mark denotes start of transition, do not install compression fitting above red mark



TA - Tube on Armor



TAC - Tube on Armor with SS12 Fitting



WP - Weld Pad

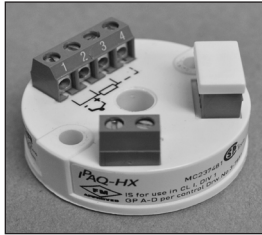


Adjustable Compression Fitting (BR18, BR14, BR12, SS18, SS14, SS12; shown is 1/2" NPT SS)

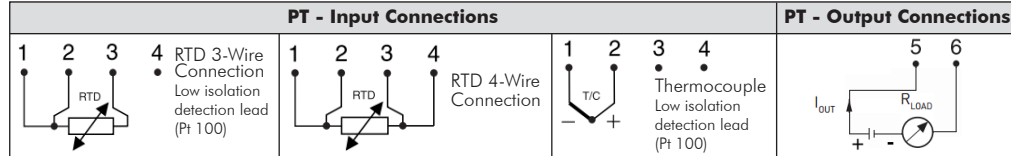
Temperature Sensors

In-Head Temperature Transmitters

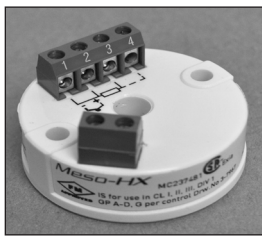
Programmable Type PT



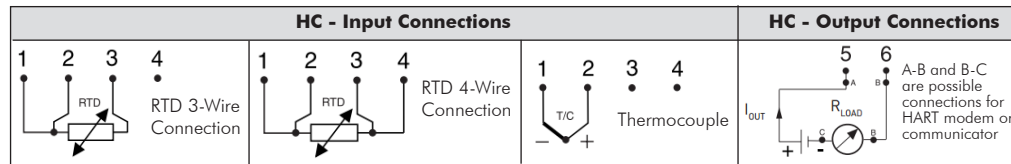
- Input-Output isolation - excellent filtering of voltage spikes and elimination of ground loops
- Accepts RTD and T/C inputs
- Full access to all features while in operation
- Selectable sensor break function - upscale or downscale
- Long term stability 0.1% / year
- Fast response - measuring frequency of appr. 6 per second update time down to 170 ms
- Sensor error correction can be matched
- 5 Year Warranty
- Easy to use Windows configuration software
- NAMUR compliant
- FM and Cenelec approval



Hart® Programmable Type HC



- Utilizes Hart® protocol for configuration and monitoring; communicates with Hart® communicator or modem
- Input-Output isolation eliminates measuring errors due to ground loops
- Long term stability 0.1% / year
- Accepts RTD and T/C inputs
- Sensor error correction compensates for known sensor errors
- Customized 50 point linearization any sensor can be matched
- Selectable sensor break function
- Full access to all features while in operation
- FM & Cenelec approvals
- NAMUR compliant
- 5 Year Warranty



SPECIFICATIONS	Type PT	Type HC
Input RTD* and Resistance	3,4-wire connection	3,4-wire connection
Pt100 (α=0.00385)	-200 to +1000°C / -328 to +1832°F	-200 to +1000°C / -328 to +1832°F
Pt1000 (α=0.00385)	-200 to +200°C / -328 to +392°F	-200 to +200°C / -328 to +392°F
Input Thermocouples	E, J, K, N, R, S, T	E, J, K, N, R, S, T
Input Voltage	-10 to +500mV	-10 to +500mV
Sensor failure	User definable output	User definable output
Adjustments - Zero	Any value within range limits	Any value within range limits
Pt100, Pt1000 10°C / 18°F	10°C / 18°F	
T/C, mV	2mV	2mV
Output	4-20 / 20-4 mA	4-20 / 20-4 mA
Operating temperature	-40 to +85°C / -40 to +185°F	-40 to +85°C / -40 to +185°F
Galvanic isolation	1500 VAC, 1 min	1500 VAC, 1 min
Power supply	8.0 to 30 VDC	8.0 to 30 VDC
Intrinsic safety	Cenelec: EEx ia IIC T4-T6 ATEX: II 1 G FM: Class I-III, Div. 1, Gr.A-D	Cenelec: EEx ia IIC T4-T6 ATEX: II 1 G FM: Class I-III, Div. 1, Gr.A-D
Accuracy	± 0.1% of temperature span	± 0.1% of temperature span

* Consult factory for other RTDs

To order indicate a code/value for each component.

- For factory configuration specify option FC.
- The transmitter will be programmed for the specified range and sensor type.
- The user can not change the programmed features without the factory supplied communications cable.
- To order the communications cable (only one on the PT required regardless of the number of transmitters) specify part number 701PRX0001.

TRANSMITTER								
Type	Range	Sensor Input	Head		Options			
PT	Specify in F or C i.e. 0-200°F	J, K, N, E, T, R, S, Pt 100 Pt 1000	O	No Head	EPA	Explosion Proof Aluminum	FC	Factory Configured
HC			CA	Cast Aluminum	EPAA	Explosion Proof Aluminum Atex	FW	Four Wire RTD
			CI	Cast Iron	EPS	Explosion Proof Stainless Steel	LPI	Loop Powered Indicator (see page 28)
			CSS	Cast Stainless Steel	EHA	Explosion Proof Aluminum	CC	Communications Cable (required to configure PT)
			FTA	Flip Top Aluminum	EHI	Explosion Proof Iron		

(see pages 18-19 for specifications)

Programmable
Type LCP



SPECIFICATIONS	Type LCP
Input RTD	RTD 2,3, or 4 Wire Pt100 ($\alpha=0.00385$)
Sensor Failure	Upscale
Output	4-20 mA
Operating Temperature	-40°F to +185°F (-40°C to +85°C)
Galvanic Isolation	NO
Power Supply	8.5 to 30 VDC
Intrinsic Safety	FM: Class I, Div. 1, Gr. A-D
Accuracy at 23°C	+/-0.1% of span
Linearization	Temperature Linear Output

LCP - Input and Output Connections		
<p>2 wire RTD PT100</p>	<p>3 wire RTD PT 100</p>	<p>4 wire RTD PT100</p>

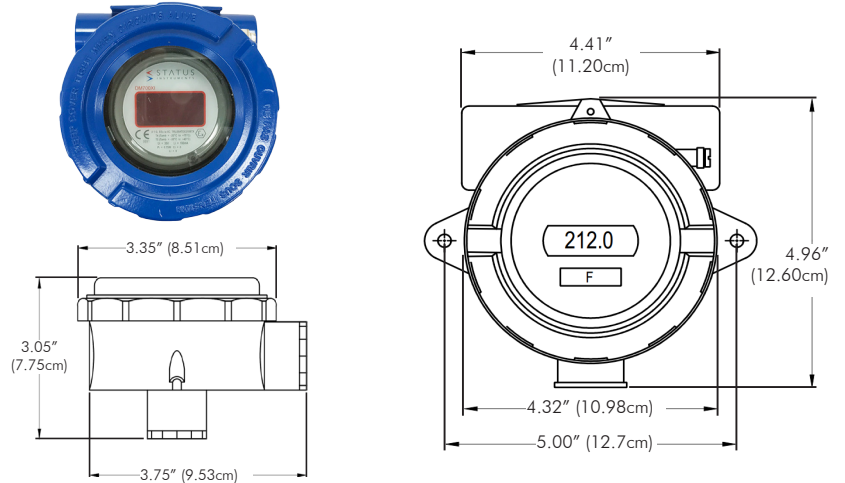
To order indicate a code/value for each component.

TRANSMITTER				
LPC				FC
Type	Range	Sensor	Head	Options
	Specify in F or C i.e. 0-200F	2 Wire 3 Wire 4 Wire	CA FTA	Factory Configuration

Loop Powered Indicator

LPI, LPIX

SPECIFICATIONS	LPI	LPIX
Display		4 Digit LED
Power		Loop Powered
Loop Drop		<4.0 V @ 20 mA
Input		4-20mA Input
Range		-1999 to 9999 DP
Certification	NEMA 4X	FM - CSA - ATEX
	IP67	Class I Groups A, B, C, D
		Class II Groups E, F, G
	NEMA 4X (Blue Epoxy Coated)	

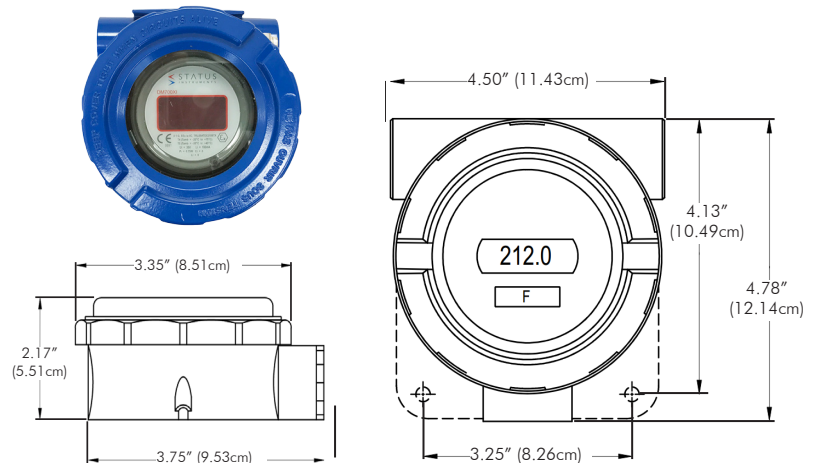


Battery Powered Indicator

Option BPI, BPIX

SPECIFICATIONS	BPI	BPIX
Display		4 Digit LCD
		Menu Selectable - RTD/TC Type
Battery		Single AA size Lithium
		Thionyl Chloride 3.6V
Power		Life 3 years minimum
Input		Pt100
Accuracy		0.30°F (0.17° C) +/- 0.1% Rdg
Input Accuracy		K, J, E (other calibrations available)
		+/- 0.1% FS +/- 0.9°F (+/- 0.5°C)
Certification	NEMA 4X	FM - CSA - ATEX
	IP67	Class I Groups A, B, C, D
		Class II Groups E, F, G
	NEMA 4X (Blue Epoxy Coated)	

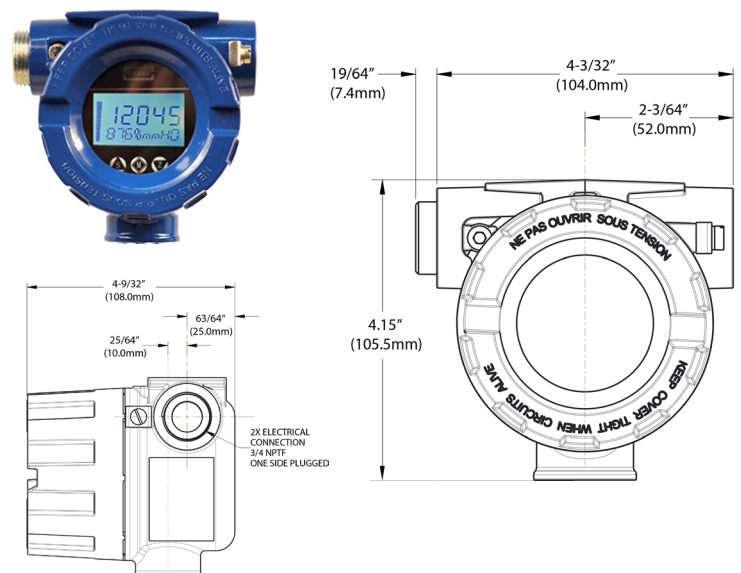
Temperature Ranges	Type	°F	°C
	K	-328 to 2498	-200 to 1370
	J	-328 to 2192	-200 to 1200
	E	-328 to 1832	-200 to 1000
	Pt100	-328 to 1562	-200 to 850



Loop Powered Direct Mount Indicator

Option LPCX

SPECIFICATIONS		
Display	5-digit Backlit LCD (4½ neg; 5 pos)	
Power	Loop Powered (18-36 VDC)	
Loop Drop	8.0 V Max	
Input	4-20mA Input	
Input Accuracy	<=0.1% F.S.	
Certification	FM - CSA - ATEX	
	Class I Groups A,B,C,D	Class 1, Zone 1, AEx dIIC
	Class II Groups E,F,G	IEC Ex d II C
	NEMA 4X	IP68



Adjustable Angle Bimetal Thermometer

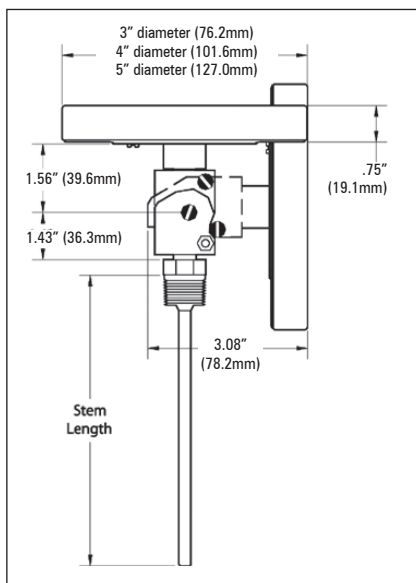
The bimetal thermometers are reliable and accurate temperature sensors requiring no electricity or wiring. Adjustable angle thermometers allow for easy temperature monitoring from any position and they are ideal for local indication. They can be recalibrated with a turn of the calibration screw on the back of the dial. A variety of options are available for your specific process needs.



To order indicate a code/value for each component.

THERMOMETER					
TI-SOR					
Type	Model	Stem Length	Connection	Range	Options
A3	3" Dial w/ Reset	2.5" (63.5 mm)	A 1/2" NPT	Fahrenheit Ranges F23 -40°F to 160°F	General Options (Choose up to 4) PS = Pointed Stem
A4	4" Dial w/ Reset	4" (101.6 mm)	B 3/4" NPT Adapter	F55 25°F to 125°F*	S3 = 3/8" diameter Stem
A5	5" Dial w/ Reset	6" (152.4 mm)	C 1/2" NPT Adjustable	F43 0°F to 200°F	SF = Silicone Filled
		9" (228.6 mm)	Sanitary	F47 0°F to 250°F	SS = 316 Stainless Stem
		12" (304.8 mm)	D 3/4" Tri-Clamp®	F63 50°F to 300°F	HV = Hi-Vis™ Dial (High Visibility)
		15" (381.0 mm)	E 1.5" Tri-Clamp®	F67 50°F to 500°F	F5 = 5/16" diameter Stem
		18" (457.2 mm)	F 2" Tri-Clamp®	F69 50°F to 550°F	Window Options (Std. is glass)
		24" (609.6 mm)		F81 150°F to 750°F	MM = Min-Max Pointer (Plastic Lens)
		30" (762.0 mm)		F85 200°F to 1000°F	PC = Acrylic Window
		36" (914.4 mm)		Celsius Ranges	PY = Polycarbonate Window
		Note: Intermediate stem lengths available up to 80" (203.2 cm).		C23 -40°C to 70°C	TG = Tempered Glass Window
				C55 0°C to 50°C*	SG = Laminated Safety Glass
				C43 0°C to 100°C	Calibration Cert. Options
				C47 -20°C to 120°C	C1 = One Point Calibration Cert
				C59 0°C to 150°C	C3 = Three Point Calibration Cert
				C67 0°C to 250°C	CC = Certificate of Conformance
				C69 0°C to 300°C	
				C73 0°C to 400°C	
				C85 100°C to 500°C	
				Dual Scale Ranges	
				D23 -40°F to 160°F & -40°C to 70°C	
				D55 25°F to 125°F & -5°C to 50°C*	
				D43 0°F to 200°F & -10°C to 90°C	
				D47 0°F to 250°F & -20°C to 120°C	
				D63 50°F to 300°F & 10°C to 150°C	
				D67 50°F to 500°F & 10°C to 260°C	
				D69 50°F to 550°F & 10°C to 290°C	
				D81 150°F to 750°F & 70°C to 400°C	
				D85 200°F to 1000°F & 100°C to 500°C	

For Thermowells see pages 13-14



Electric Trace Sensor - Type 1500 and 1500R

TYPE 1500 - Used to accurately measure the surface temperature of any pipe or tank greater than 3 inches (7.62 cm) in diameter. The standard X and Y dimensions reduces the heat sink effect and greatly improves the accuracy. The 1500 is widely used for electric heat tracing control for freeze protection and process control, especially where changes in temperature can cause process material to stratify.

TYPE 1500R - This surface temperature design allows easy removal of the sensor. In applications where there is heavy insulation on the pipe the sensor can be removed without disturbing or removing the insulation, reducing replacement downtime and costs.

To order indicate a code/value for each component.

SENSOR TYPE						
Head Type	Type	Calibration	X	Junction	Y	Options
	1500 or 1500R		(see drawings for standard X and Y or indicate desired dimensions in inches)			

HEAD TYPE

Type 1500	0	No Head	Type 1500R
	CA	Cast Aluminum	
	CI	Cast Iron	
	CSS	Cast Stainless Steel	
	LCA	Large Cast Aluminum	
	PP	Polypropylene (Black)	
	PPS	Polypropylene Sanitary	
	FTA	Flip Top Aluminum	
	FTP	Flip Top Poly (white)	
	EPA	Explosion Proof Aluminum	
	EPS	Explosion Proof Stainless Steel	
	EHA	Explosion Proof Aluminum	
	EHI	Explosion Proof Iron	

CALIBRATION

Type 1500	J	Iron Constantan®	Type 1500R
	K	Chromel® Alumel®	
	T	Copper Constantan®	
	E	Chromel® Constantan®	
	N	Nicrosil® Nilil®	
	PO	Low Temp RTD to 500°F (260°C)	
	PH	High Temp RTD to 900°F (482°C)	
PM	Heavy Duty RTD to 900°F (482°C)		

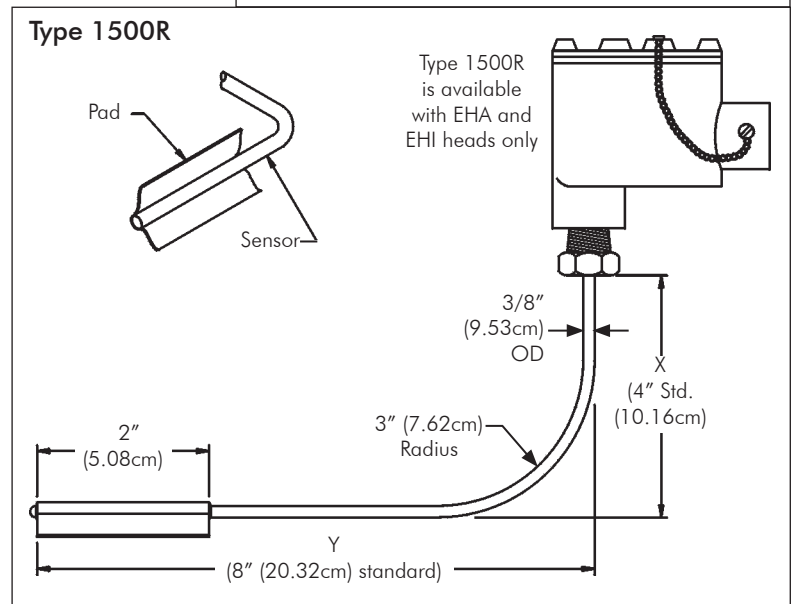
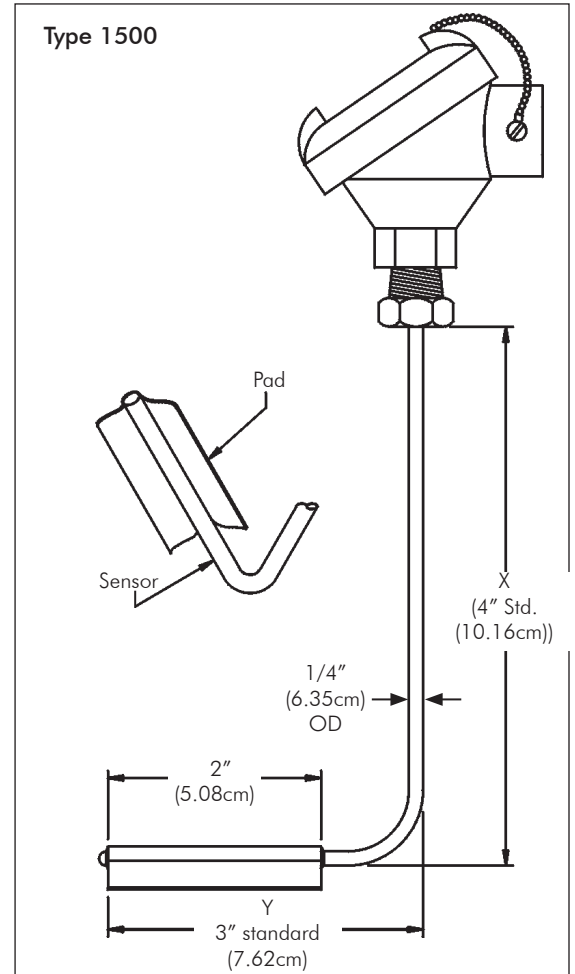
Standard RTD is a three-wire 100 ohm Platinum / .00385 Alpha. For higher temperature ranges - consult factory. For special limits on thermocouples, repeat calibration code, i.e. JJ.

SENSOR JUNCTION

Type 1500	G	Grounded	Type 1500R
	U	Ungrounded	
	DG	Dual Grounded	
	DU	Dual Ungrounded	
	S	Single RTD	
	D	Dual RTD	
	FW	Four Wire RTD	

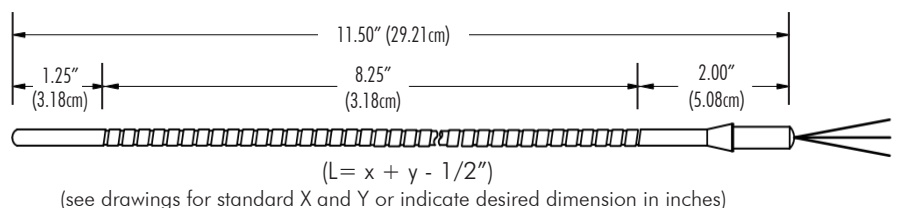
OPTIONS

- S 3/4" - 2" (19.1 mm to 50.8 mm) Specify radius
- M Radius for NPT pipe sizes 3" - 6"
- L Radius for NPT pipe sizes 6" and above



To order replacement sensor for Type 1500R: Indicate the code/value for each requirement.

SENSOR REPLACEMENT			
1500RS	11.5		
Type	RTD Type	L	Junction



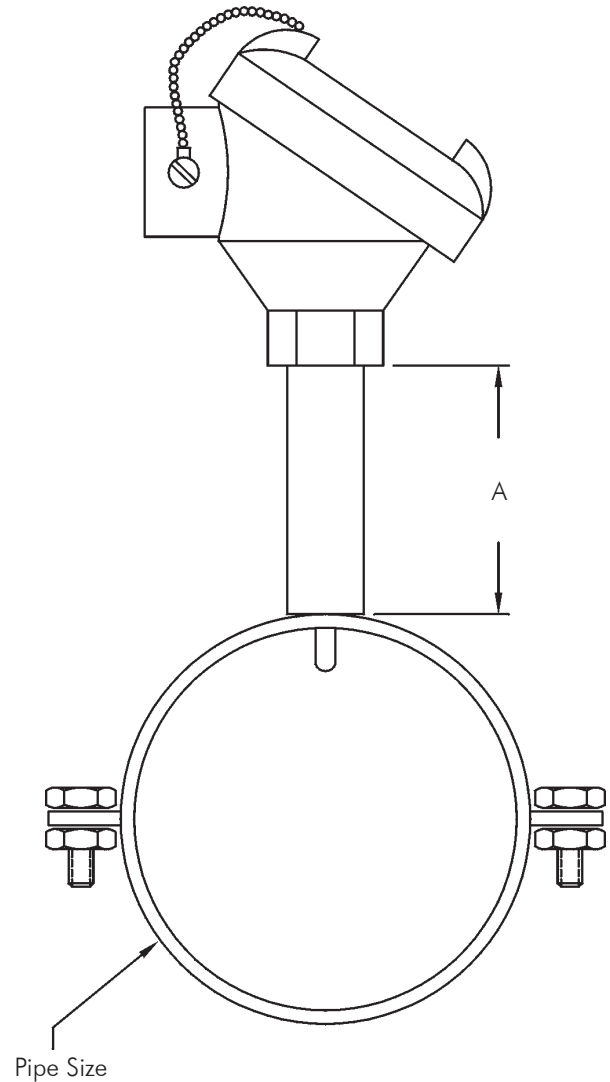
Pipe Clamp - Type 1550

For heavy duty industrial surface temperatures use Type 1550. The black carbon steel nipple is welded to the black carbon steel pipe clamp adapter and the thermocouple is springloaded and maintains constant contact with the measuring surface. "A" length is normally determined by the insulation thickness surrounding the pipe. Sensor replacement requires no disassembling. For use with pipes 4 inches (10.16 cm) in diameter or larger.

To order indicate a code/value for each component.

SENSOR TYPE					
1550					
Type	Head	A Length (inches)	Junction	Pipe Size (inches)	Calibration

SENSOR TYPE	
HEAD TYPE	
0	No Head
CA	Cast Aluminum
CI	Cast Iron
CSS	Cast Stainless Steel
PPS	Polypropylene Sanitary
FTA	Flip Top Aluminum
FTP	Flip Top Poly (white)
EPA	Explosion Proof Aluminum
EPS	Explosion Proof Stainless Steel
EHA	Explosion Proof Aluminum
EHI	Explosion Proof Iron
JUNCTION	
G	Grounded
U	Ungrounded
DG	Dual Grounded
DU	Dual Ungrounded
For special limits on thermocouples, repeat calibration code, i.e. JJ.	
CALIBRATION	
J	Iron Constantan®
K	Chromel® Alumel®



Washer Thermocouples - Type 1310

Washer thermocouples provide a simple but effective way to measure surface temperature on tanks and other welded metal structures. The thermocouple is imbedded in the washer for quick response and accurate location of the surface temperature.

Wire Gauge: 20 gauge solid (standard)

To order select a designator code for each component.

Washer Thermocouple					
1310					
Type	Calibration	Washer Size	Leadwire	Lead Wire Length (inches)	Options
	J, K, T, E	6, 8, 10, 12, 1/4" (6.4 mm), 3/8" (9.5 mm), 1/2" (12.7 mm)	F - Fiberglass, P - PVC, T - Teflon®		A - Armor, AP - Armor with PVC Jacket, SB - SS Over Braid

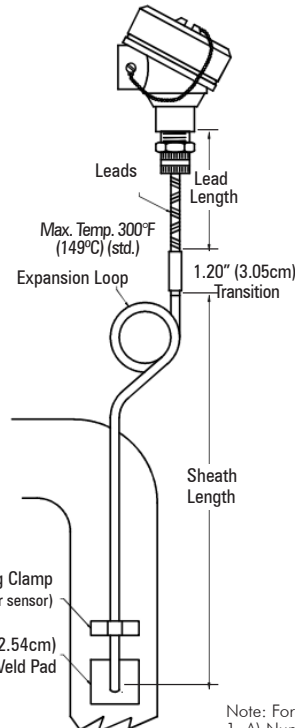
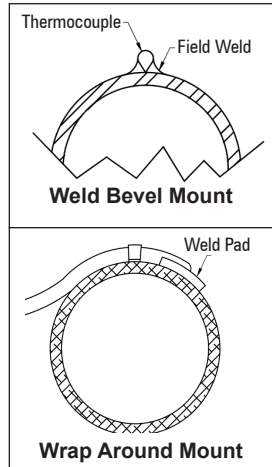


Tubeskin Thermocouples - Type 1510

To order indicate a code/value for each component.

HEAD		SENSOR TYPE							PIPE/PAD		OPTIONS	
Type	1510	Type	Calibration	OD	Junction	Sheath Length (inches)	Sheath Material	Lead Length (inches)	Lead Wire	Pipe Size NPT	Pad Mounting	

HEAD TYPE	
0	No Head
CA	Cast Aluminum
CI	Cast Iron
CSS	Cast Stainless Steel
PPS	Polypropylene Sanitary
FTA	Flip Top Aluminum
FTP	Flip Top Poly (white)
EPA	Explosion Proof Aluminum
EPS	Explosion Proof Stainless Steel
EHA	Explosion Proof Aluminum
EHI	Explosion Proof Iron
SENSOR TYPE	
CALIBRATION	
J	Iron Constantan®
K	Chromel® Alumel®
T	Copper Constantan®
E	Chromel® Constantan®
N	Nicrosil® Nisil®
OD	
18	1/8" (3.2 mm)
316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
516	5/16" (7.9 mm)
38	3/8" (9.5 mm)
JUNCTION	
G	Grounded
U	Ungrounded
DG	Dual Grounded
DU	Dual Ungrounded



SHEATH MATERIALS	
P	304SS
R	316SS
Q	310SS
A	Alloy 600
LEAD WIRE	
F	Fiberglass
T	Teflon®
P	PVC
PIPE MOUNTING	
P	Parallel
W	Wrap Around
BP	Weld Bevel - Parallel
BW	Weld Bevel - Wrap Around
F	Flat
OPTIONS	
A	Armor (Stainless Steel)
AP	Armor with PVC Jacket
BS	Bell Spring Transition Relief
CG12	Weathertight Fitting 1/2" NPT
CT	Compensated Terminals (EHA/EHI heads only)
EL	Expansion Loop
HS	Heat Shield
SB	Stainless Steel Overbraid
SS18	Adj SS Comp Fitting 1/8" NPT*
SS14	Adj SS Comp Fitting 1/4" NPT*
SS12	Adj SS Comp Fitting 1/2" NPT*
ST	Smooth Transition

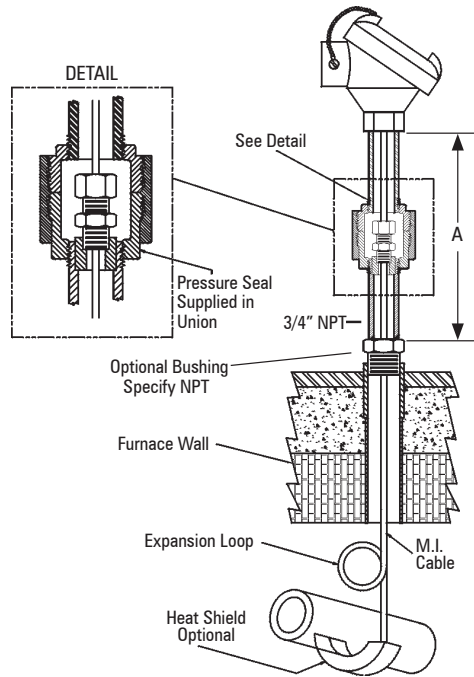
Note: For Tubeskins with Expansion Loops please provide sketch showing: 1. A) Number of loops, B) Location, C) OD of loops

Tubeskin Thermocouples - Type 1520

To order indicate a code/value for each component.

HEAD		SENSOR TYPE							PIPE/PAD		OPTIONS	
Type	1520	Type	Extension	A Length (inches)	Calibration	OD	Junction	Sheath Length (below bushing) (inches)	Sheath Material	Pipe Size NPT	Pad Mounting	

HEAD TYPE	
0	No Head
CA	Cast Aluminum
CI	Cast Iron
CSS	Cast Stainless Steel
PPS	Polypropylene Sanitary
FTA	Flip Top Aluminum
FTP	Flip Top Poly (white)
EPA	Explosion Proof Aluminum
EPS	Explosion Proof Stainless Steel
EHA	Explosion Proof Aluminum
EHI	Explosion Proof Iron
SENSOR TYPE	
EXTENSION	
N	Nipple Galvanized
NUN	Nipple/Union/Nipple Galvanized
NS	Nipple Stainless Steel
NUNS	Nipple/Union/Nipple Stainless Steel
PNUN	Pressure Seal in Union Galvanized
PNUNS	Pressure Seal in Union Stainless Steel



CALIBRATION	
J	Iron Constantan®
K	Chromel® Alumel®
T	Copper Constantan®
E	Chromel® Constantan®
N	Nicrosil® Nisil®
OD	
18	1/8" (3.2 mm)
316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
516	5/16" (7.9 mm)
38	3/8" (9.5 mm)
JUNCTION	
G	Grounded
U	Ungrounded
DG	Dual Grounded
DU	Dual Ungrounded
SHEATH MATERIALS	
P	304SS
R	316SS
Q	310SS
A	Alloy 600
PIPE MOUNTING	
P	Parallel
W	Wrap Around
BP	Weld Bevel - Parallel
BW	Weld Bevel - Wrap Around
F	Flat
OPTIONS	
BN	Process Connection NPT (NPT SIZE)
CT	Compensated Terminals (EHA/EHI heads only)
EL	Expansion Loop
HS	Heat Shield

Note: For Tubeskins with Expansion Loops please provide sketch showing: A) Number of loops, B) Location, C) OD of loops

Oil Seal - Type 1312 & 1314

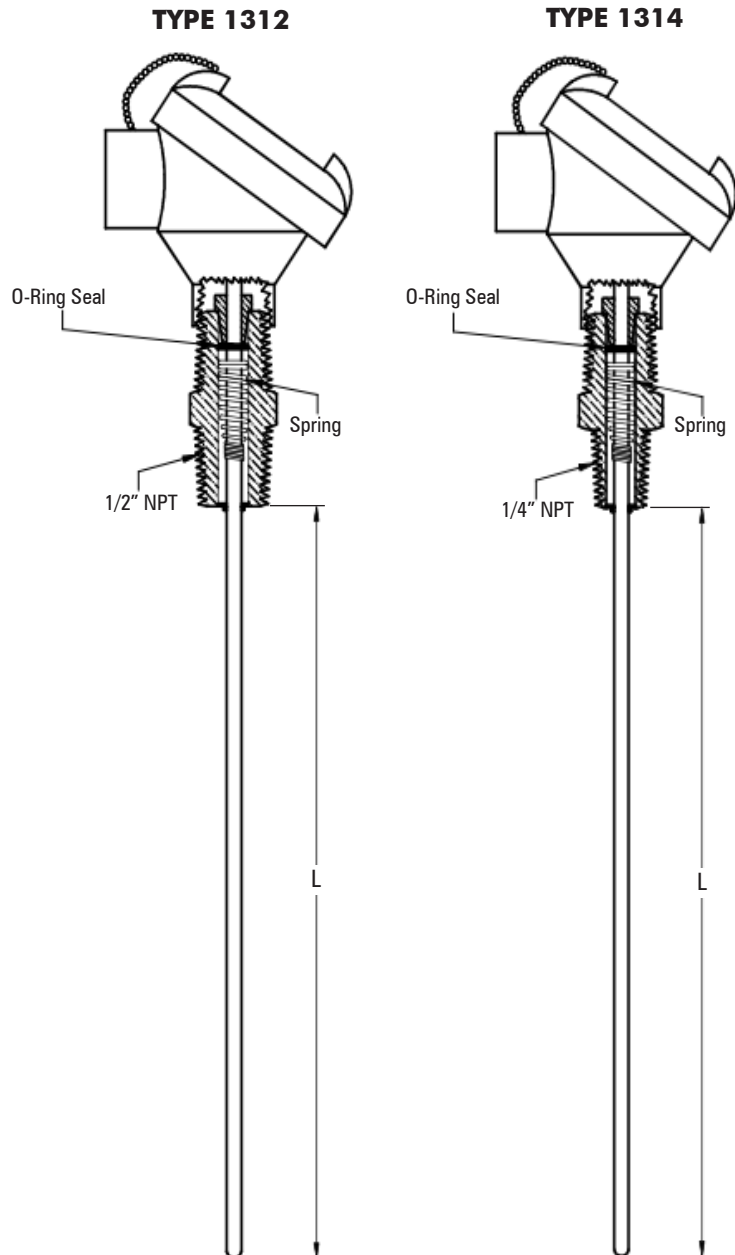
When a bearing is not properly lubricated, premature failure can occur. This failure can prove to be costly. This design has proven successful in measuring various types of bearing temperatures. The sensor provides quick response alerting the operator to an overheated condition. The O-ring prevents lubricants from contaminating components in the head and designed not to swell even when in continuous contact with oils and synthetic lubricants. This feature allows the spring to maintain positive pressure against the bearing housing and assures good temperature readings. This sensor is available with 316SS sheath and 3/16" (4.8 mm) OD. Cast aluminum head is standard. Maximum temperature 400°F (204°C), maximum pressure 50 psi (3.447 bar).

To order indicate a code/value for each component.

HEAD		SENSOR TYPE			
			316		
Type	Type	Calibration	OD 316 = 3/16" (4.762 mm)	Junction	Length (inches below fitting)

HEAD TYPE	
0	No Head
CA	Cast Aluminum
CI	Cast Iron
CSS	Cast Stainless Steel
PPS	Polypropylene Sanitary
FTA	Flip Top Aluminum
FTP	Flip Top Poly (white)
EPA	Explosion Proof Aluminum
EPS	Explosion Proof Stainless Steel
EHA	Explosion Proof Aluminum
EHI	Explosion Proof Iron

SENSOR	
TYPE	
1312	1/2" NPT Process
1314	1/4" NPT Process
CALIBRATION	
J	Iron Constantan®
K	Chromel® Alumel®
T	Copper Constantan®
E	Chromel® Constantan®
N	Nicrosil® Nisil®
PO	Low Temp RTD to 500°F (260°C)
PH	High Temp RTD to 900°F (482°C)
PM	Heavy Duty RTD to 900°F (482°C)
Standard RTD is a three-wire 100 ohm Platinum/.00385 Alpha. For higher temperature ranges - consult factory. For special limits on thermocouples, repeat calibration code, i.e. JJ.	
JUNCTION	
G	Grounded
U	Ungrounded
DG	Dual Grounded
DU	Dual Ungrounded
S	Single RTD
D	Dual RTD
OPTIONS	
FW	Four Wire
GA	Class A (RTD Only)



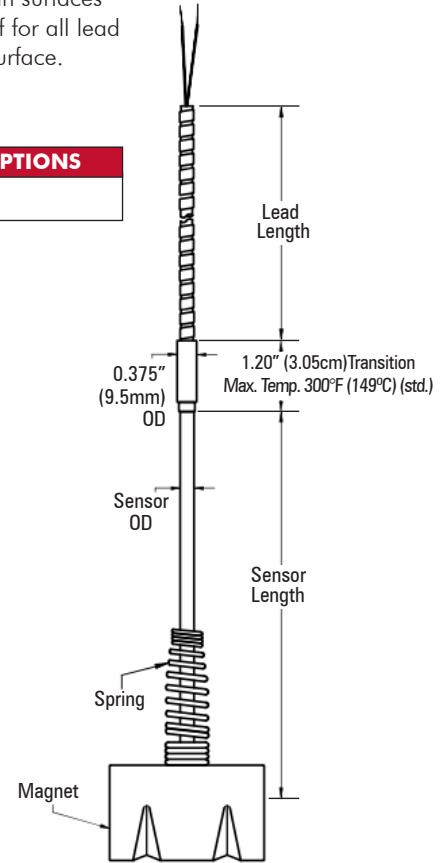
Heavy Duty Industrial Magnet Thermocouple - Type 1280

This rugged magnet thermocouple provides hands free surface measurement of tanks, bearing housings, pipes and air ducts. The 25-pound minimum pull magnet allows a strong attachment to rust free and clean surfaces and may be used for temperatures up to 950°F (510°C). A standard bell spring provides stress relief for all lead wire constructions. The optional handle allows proper positioning of the magnet to the measuring surface.

To order indicate a code/value for each component.

SENSOR TYPE								TERMINATION	OPTIONS
1280					R				
Sensor Type	Calibration	OD	Junction	Sheath Length (inches)	Sheath Material	Lead Length (inches)	Lead Insulation		

SENSOR	
CALIBRATION	
J	Iron Constantan®
K	Chromel® Alumel®
OD	
18	1/8" (3.2 mm)
316	3/16" (4.8 mm)
14	1/4" (6.4 mm)
JUNCTION	
G	Grounded
U	Ungrounded
DG	Dual Grounded
DU	Dual Ungrounded
SHEATH MATERIAL	
R	316SS
LEAD INSULATION	
T	Teflon® 20 gauge solid
MT	Multi Strand (flexible) Teflon® 20 gauge
TERMINATION	
1	Bare Ends
2	Large Plug
3	Miniature Plug
8	Dual Large Plug
11	Compensated Spade Lugs
OPTIONS	
A	Armor (Stainless Steel)
AP	Armor with PVC Jacket
HDL	Handle



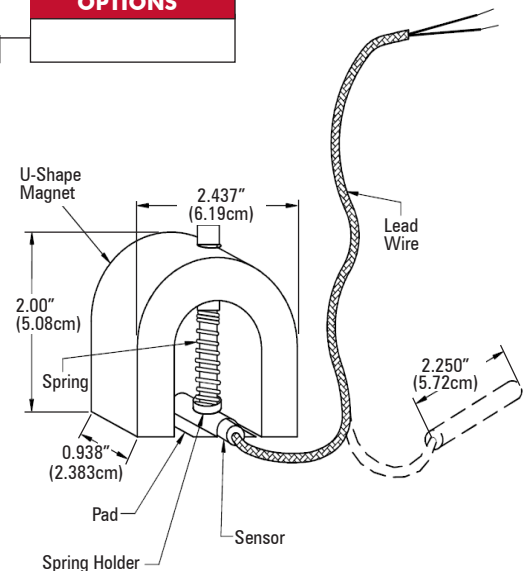
Heavy Duty Industrial Magnet RTD - Type 1290

When the application requires a temporary RTD surface measurement or has a difficult mounting position - this assembly with a heavy duty magnet could be the solution. Sensor can be easily replaced without removing the magnet or holder and a variety of sensor options are available.

To order indicate a code/value for each component.

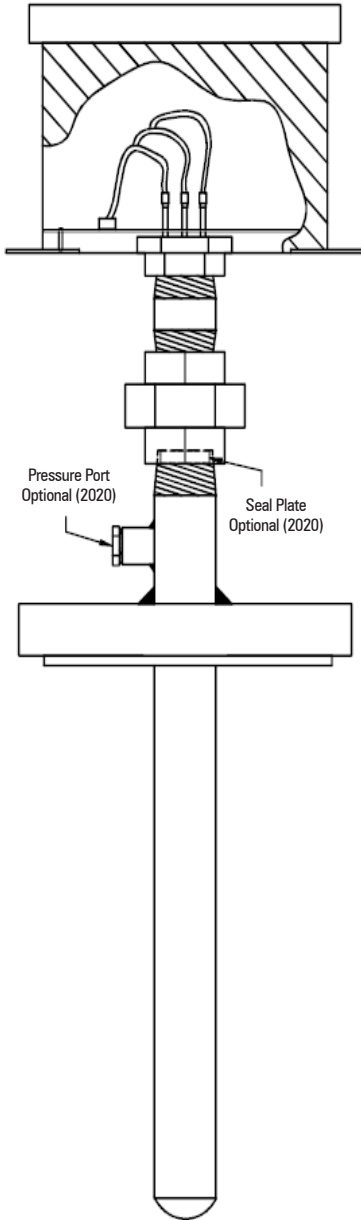
SENSOR TYPE								TERMINATION	OPTIONS
1290		14		2.25"	R				
Sensor Type	RTD Type	OD	Junction	Sheath Length (inches)	Sheath Material	Lead Length (inches)	Lead Insulation		

SENSOR	
Sensor Type	
PO	Low Temp RTD to 500°F (260°C)
PH	High Temp RTD to 900°F (482°C)
PM	Heavy Duty RTD to 900°F (482°C)
OD	
14	1/4" (6.4 mm)
Junction	
S	Single RTD
D	Dual RTD
SHEATH MATERIAL	
R	316SS
LEAD INSULATION	
MF	Multi Strand (flexible) Fiberglass 22 gauge.
MT	Multi Strand (flexible) Teflon® 22 gauge.
TERMINATION	
1	Bare Ends
11	Spade Lugs
12	Large Three Pin Plug
14	Mini Three Pin Plug
OPTIONS	
A	Armor (Stainless Steel)
AP	Armor with PVC Jacket
SB	Stainless Steel Overbraid Leads



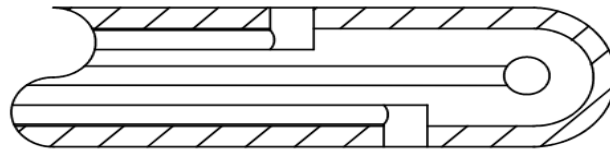
Temperature profiling is important whenever multiple points of measurement are required over a broad measuring range. Multiple Sensor Assemblies or Multipoints as they are commonly referred to can be designed with using either thermocouples or RTDs and in some cases both. As illustrated above, secondary seals can be supplied for even greater safety assurance. These seals prevent process fluids or gasses from escaping in the event of a process upset. In critical applications component testing is recommended. Dye penetrated, X-ray, and hydrostatic testing are standard available tests.

In order to be effective these assemblies must be able to provide temperature point location with a tolerance of plus or minus .25 inches (6.4 mm) and comparable sensor accuracy throughout the entire measuring range. Our calibration method and positive point identification assures like sensor accuracy and accurate and safe performance.



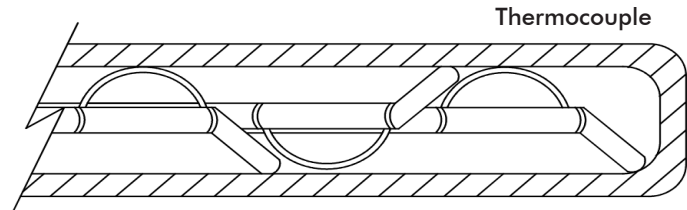
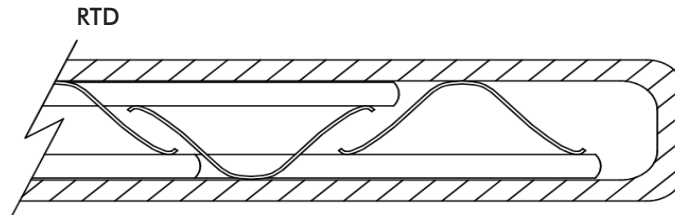
Guide Tube and Blocks Thermocouple - Type 2020

Sensors are installed into guide tubes which are terminated at the hot end into heat transfer blocks. These blocks are welded into the wall of the protection tube at the required points along the well. This facilitates faster response time, improved accuracy and positive point identification. Individual sensors can be removed while the unit is operating and without disrupting the process. This design lends itself to insertion in a secondary seal construction.



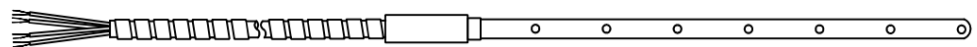
Positive Contact Thermocouple or RTD - Type 2030

This design maintains positive sensor contact to the inside wall of the protection tube for improved accuracy and response time. The sensors can be installed as a bundle with a support strip or individually. Sensors can be individually replaced.



Miniature Multi Thermocouple or RTD - Type 2040

Several sensors are accurately positioned in a stainless steel tube and each sensor is transitioned to flexible leads. This construction does not require a protection tube.



To Order - provide a sketch with the following information

- Specify Thermocouple Calibration
- Specify Thermocouple Junction-Grounded or Ungrounded
- Specify RTD Type
- Number of Sensors
- Length of each Sensor (measured from the process connection to its measuring point in the pipe well)
- Tube OD
- Tube Material
- Tube Length
- Process Connection
- Lead Length of Sensor
- Lead Insulation
- Lead Termination



MEASUREMENT AND CONTROL

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